

Chapter 3: Affected Environment

This chapter describes the existing social, economic, and environmental conditions in the Southern Corridor study area and serves as a baseline for comparing impacts associated with the Southern Corridor project alternatives. Chapter 4, Environmental Consequences, documents the potential social, economic, and environmental impacts from the Southern Corridor.

The study area is located in Washington County, Utah, and is bordered on the south by Arizona and on the west by Nevada. The area is undeveloped desert except for a few homes near SR 9. The main population centers of St. George, Hurricane, and Washington City are located to the north and west. The study area is used for unorganized recreational activities, grazing, and small-scale agriculture.

3.1 Land Use

This section addresses current land use policies in each jurisdiction of the study area and describes current land use by local land use plans and regional land use planning studies.

Both the general study area and specific Southern Corridor alternatives were analyzed. The general study area largely coincides with the Washington County boundary, of which the primary population centers are St. George, Washington City, and Hurricane. The specific Southern Corridor alternatives begin on I-15 south of St. George, run east and northeast, and connect with SR 9 in Hurricane.

Most of the land in the study area is open space, with some land being used for cattle grazing, small-scale agriculture, and/or unorganized recreational activities such as motorcycle, all-terrain vehicle (ATV), and off-highway vehicle (OHV) use. With the increase in population, the area's land use is rapidly changing from open space to residential.

3.1.1 Land Ownership

Land ownership in the study area of Washington County consists of about 86% publicly owned and 14% privately owned lands. The majority of the land within the Southern Corridor alternatives is owned by public entities. Figure 3-1, Existing Land Use and Ownership within 1 Mile of the Alternatives, provides an overview of the land ownership along the Southern Corridor alternatives. Table 3.1-1 describes the land ownership in the study area.

Table 3.1-1. Land Ownership by Acreage

Entity	Acreage in Washington County	Approximate Acreage in Study Area
Bureau of Land Management	629,005	9,600
U.S. Forest Service	425,285	—
National Park Service	143,605	—
Bureau of Indian Affairs	27,890	—
State of Utah	101,040	5,500
Private Lands	255,060	7,700
Total	1,581,885	22,800
Source: BLM 1998		

Most of the federal lands in the general study area are administered by BLM, with smaller portions being managed by the National Park Service, Bureau of Indian Affairs, and U.S. Forest Service. The Federal Land Policy Management Act requires plans for all federally managed lands to be coordinated to the extent possible, consistent with federal laws, regulations, and policies, with those plans of the local communities (Winston Associates, Inc. and others 1997). Therefore, city land use plans often indicate a future use for federal lands.

The State of Utah lands within the study area are owned by SITLA. The beneficiaries of state trust lands are school trusts and 11 other public institutions. SITLA is essentially the only source of new private land in Utah (Utah Trust Lands 2001), and primarily uses its land for development. Much of the SITLA land in the study area is planned for commercial, industrial, and residential development.

3.1.2 Existing Land Use

Washington County land use is primarily open space, except for the main population centers of St. George, Washington City, and Hurricane. Public lands in Washington County include a national forest, national and state parks, wilderness areas, agricultural lands, and open space. The Dixie National Forest consists of about 2 million acres of forest in the northwest and north-central parts of Washington County (U.S. Forest Service 2001). The Pine Valley Wilderness Area covers about 50,000 acres of land within Dixie National Forest (Gorp.com, no date) and the BLM-administered Beaver Dam Mountains Wilderness Area covers about 2,700 acres. Zion National Park consists of about 147,000 acres of land in the north and northeast areas of Washington County (Zion National Park 2001).

Current land use within 1 mile of the proposed Southern Corridor alternatives is a mixture of undeveloped desert (including grazing), residential, agricultural, industrial, and commercial, as shown in Figure 3-1, Existing Land Use and Ownership within 1 Mile of the Alternatives. The western end of the study area is undeveloped desert primarily used for recreation by ATVs and motorcycles. Immediately east of Fort Pearce Wash, the study area is used for range grazing by cattle and motorized recreational uses (see Section 3.2.5, Grazing Allotments).

As the alternatives head north, there are three residential units along Warner Ridge and next to the proposed Red Hawk subdivision. North of this, the study area intersects a junkyard (an industrial land use). North of the junkyard, the study area is undeveloped desert until it heads east and crosses the Mountain Man recreation site (see Section 3.3.9, Recreation Resources). The northern end of the study area includes mostly undeveloped desert, some agricultural and pasture land, and the proposed Sand Hollow Recreation Area. The northern end of the alternatives includes scattered residential areas. The study area along SR 9 includes residential, commercial, and industrial uses.

3.1.3 Local Land Use Plans

The Utah State Legislature has delegated to counties and cities the responsibility of developing general or comprehensive plans for orderly land development within their jurisdictional boundaries. These plans identify the future land use and associated infrastructure. Draft plans are released to the public for review and are then approved by elected officials. All plans discussed in this section have been developed according to this general approach and represent the land use designations and community types desired by each local government.

3.1.3.1 Washington County

General Study Area. The planned changes in Washington County land use are associated with agricultural, residential, and open space, as shown in Figure 3-2, Washington County Land Use. When compared to the county zoning, there is a greater area designated for agricultural land use north of the Dixie National Forest and east and northeast of La Verkin. Areas zoned as agricultural and open space are shown in the Washington County land use plan as residential within Dixie National Forest, north of the Ash Creek Reservoir, and near the cities of Gunlock, Veyo, Brookside, Diamond Valley, Winchester Hills, Kolob, Hurricane, Apple Valley, Big Plain Junction, and Hilddale (Washington City, no date).

Southern Corridor Alternatives. The Washington County General Plan indicates minor differences between zoning and land use within the Southern Corridor

alternatives. A small area north of the alternatives along the southeastern city limits of St. George is planned as agricultural. Increased designations for residential on the south and southwest edges of Hurricane are indicated. The proposed Southern Corridor project is not shown as part of the land use plan for Washington County.

3.1.3.2 St. George

General Study Area. The Land Use Plan for the City of St. George shows the majority of the city as residential and commercial use, as shown in Figure 3-3, St. George Land Use. The City plans to retain open space in the north-central part of St. George. However, the open space currently in the south-central part of the city will be decreased in size and is planned for development into a town center and with residential land uses (St. George Planning, no date).

Southern Corridor Alternatives. The proposed Southern Corridor project is shown as part of the Land Use Plan for the City of St. George; see Figure 3-3. The alternatives would start from I-15, pass through a commercial area, and then follow the southern city limits next to a large area planned for the St. George replacement airport, a town center, residential uses, and open space. The Southern Corridor would serve as a primary arterial to this new development, known as Leucadia.

3.1.3.3 Washington City

General Study Area. The Washington City Consensus Master Land Use Plan indicates an increase in residential areas and a decrease in open space, as shown in Figure 3-4, Washington City Master Land Use Plan. The areas that are currently open space on the eastern and southern edges of the city limits are shown as residential. However, an area of open space remains on the northern part of the city limits and is part of the Red Cliffs Desert Reserve. Commercial and industrial land use remains concentrated along I-15 (Chong and Associates 1997).

Southern Corridor Alternatives. The part of the Southern Corridor within Washington City limits is identified in the Consensus Master Land Use Plan (Chong and Associates 1997). The land use plan indicates low-density residential along the area proposed for the Southern Corridor.

3.1.3.4 Hurricane

General Study Area. Figure 3-5, Hurricane City Future Land Use Map, allows for a heavy increase in residential areas with small pockets of commercial use. Open space and areas designated for agricultural use are located in relatively thin bands bordering the city limits. The areas along SR 9 remain designated for commercial uses (Hurricane City 1997b).

Southern Corridor Alternatives. Within the Southern Corridor alternatives, the Hurricane City Future Land Use map also indicates residential areas, consistent with the Washington County General Plan. The areas currently used for agriculture are planned for conversion to residential use with sporadic areas of commercial, business, and industrial uses. One area is designated as open space for recreational use. Current land use reflects the plan for greater residential use, as the number of low-density residential areas within this area has increased in the past 5 years (Foran 2001). The SR 9 corridor remains designated for commercial uses.

The Southern Corridor was not included as part of the Hurricane City Future Land Use map (Hurricane City 1997b). The land use plan indicates a mix of residential, commercial, recreational, and open space within the Southern Corridor study area.

3.2 Farmlands

This section discusses general farmland trends, crops, grazing allotments, and farmland within the study area specially classified as prime, unique, and state-important. For this section, the study area is defined as any location where the build alternatives would prevent, reduce, or prohibit farming.

There are 33,700 total acres of cropland in Washington County. Of this, about 18,300 acres are used for irrigated crops and about 15,400 acres are used for nonirrigated crops. The proposed Southern Corridor alternatives fall within undeveloped desert, except for a few irrigated fields along the northeast end of the 3400 West Alternative.

3.2.1 Current Agricultural Production

Information on irrigated crops was obtained from the local U.S. Department of Agriculture (USDA) office in St. George. According to discussions with USDA and the Natural Resources Conservation Service (NRCS), the majority of crops in the study area are pecans, peaches, grazing areas, and sod farms.

3.2.2 Prime Farmland

The Farmland Protection Policy Act of 1981 requires that federal projects minimize conversion of farmland to nonagricultural uses, and that such projects consider state and local farmland protection policies to the extent practical. Specially classified farmlands receive close scrutiny under this Act.

Prime farmland is defined as land that has the best combination of physical and chemical characteristics for producing food, feed, forage, fiber, and oilseed crops and is available for these uses. The land must have the soil quality, growing season, and moisture supply needed to economically produce sustained high yields of crops when treated and managed (including water management) according to acceptable farming methods.

Figure 3-6, Prime and Unique Farmland Adjacent to Southern Corridor Alternatives, shows prime farmland adjacent to the Southern Corridor as designated by USDA NRCS in the Soil Survey of Washington County. Although soils in the area indicate prime farmland, much land remains fallow.

3.2.3 Unique Farmland

Unique farmland is defined as land other than prime farmland used for the production of specific high-value food and fiber crops. Examples of such crops are citrus, tree nuts, olives, cranberries, fruit, and vegetables (Speth 1980). Figure 3-6 shows unique farmland (pecan and peach orchards).

3.2.4 Farmland of State Importance

State-important farmland is classified by NRCS as farmland of lesser quality than prime farmland but having the soil, water supply, and other characteristics that, with good management, yield productive crops (Utah Agricultural Experiment Station 1983). There are no state-important farmlands within the study area.

3.2.5 Grazing Allotments

This section discusses BLM grazing allotments within the study area. For this section, the study area is defined as any location where the proposed Southern Corridor would limit or prohibit grazing. See Figure 3-7, BLM Grazing Allotments within Study Area, for the location of the five grazing permits currently issued in the study area by BLM.

Grazing allotments in the study area are shown in Table 3.2-1. Grazing allotments occur on private, state, and public land managed by BLM.

Table 3.2-1. Grazing Allotments in the Study Area

Allotment Name	Public Acreage	Total Acreage	Number of Cattle	Season of Use	Public AUM	Total AUM
Warner Ridge	2,065	2,535	20	Dec 1–Apr 30	100	100
Dome	2,120	2,830	43	Dec 1–May 15	218	237
Warner Valley	890	1,255	22	Dec 1–May 15	124	124
Sand	2,270	2,270	41	Oct 1–May 20	276	276
Sand Mountain	14,075	15,560	222	Oct 21–May 20	1,547	1,547
Total	21,420	24,450	348	—	2,265	2,284

AUM = Animal unit month; the amount of forage required to sustain one cow for one month

Source: Leany 2001

Regionally, Washington County supports about 100 grazing allotments on about 576,000 acres, nearly all for cattle. Livestock operations have been heavily affected by urban growth, increased recreation and OHV use, periodic drought, increased vandalism, fluctuating markets, increased price of feed, and reduced grazing privileges due to public land exchanges, as well as management constraints for the protection of threatened or endangered species and other environmental values (BLM 1998).

3.3 Social Environment

The social environment includes the factors that affect the functioning of human society. The discussion of the social environment is divided into the following parts:

- Population Growth (current and projected)
- Population Demographics (socially disadvantaged groups and environmental justice)
- Neighborhood and Community Cohesion
- Travel Patterns and Accessibility
- Public Facilities
- Public Services and Utilities
- Quality of Life
- Public Health and Safety
- Recreation Resources

The general study area for this analysis coincides mainly with the Washington County boundary, within which there are several small population centers including St. George, Hurricane, and Washington City. However, because additional data describing the area where the specific Southern Corridor

alternatives would be constructed were available for certain parts of this study, a study area for the specific Southern Corridor alignments is also discussed. The specific Southern Corridor alignments begin south of St. George on I-15 and run east and northeast until they connect to SR 9 in Hurricane. The parts of this study that contain data for both the general study area and the specific Southern Corridor alignments are Population Demographics, Public Facilities, and Public Services and Utilities.

3.3.1 Population Growth: Current and Projected

The population of the general study area has increased at a higher annual rate than that of Utah, and this trend is projected to continue over the study period of 2000 to 2030 (see Table 1.5-1, 1994–2030 Population and Dwelling Unit Growth Rates). Between 1970 and 2000, St. George and Hurricane had annual growth rates near 7% and 6%, respectively, and Washington City experienced an annual growth rate of over 8%. During this same period, the population of Utah grew at an annual rate of 2.5%. Projections indicate that the annual growth of Hurricane and Washington City will continue to increase at a rate of about 3% and St. George at a rate of about 4%, while the state is projected to grow at an annual rate of about 2% (GOPB 2000b).

The general study area is in transition from a relatively rural area to a more urbanized one. Table 3.3-1 summarizes the population density of Utah, Washington County, and the three major cities in the general study area. Since 1980, population density has increased on the state, county, and city levels, with the exception of Washington City. The population density of Washington City decreased from 1980 to 1990 due to land annexation in the southern part of the city (Maynes 2001). However, the population density of Washington City increased from 1990 to 2000. Based on population projections through the year 2030, the increase in population density at the state, county, and city levels is expected to continue.

Table 3.3-1. Population Density

Area	Persons per Square Mile		
	1980	1990	2000
Utah	17.8	21.0	27.2
Washington County	10.8	20.0	37.2
St. George	523.0	495.9	771.2
Hurricane	—	177.4	265.2
Washington City	552.0	166.4	259.7
Source: Hyde 2001			

3.3.2 Population Demographics: Socially Disadvantaged Groups and Environmental Justice

Environmental justice addresses equity in all federally funded programs and activities, in compliance with Title VI of the 1964 Civil Rights Act and Executive Order (EO) 12898 (Federal Actions to Address Environmental Justice in Minority and Low-Income Populations). According to Title VI and EO 12898, federal agencies must identify and address the possibly disproportionately high adverse environmental effects on minority and low-income populations, referred to as environmental justice populations, before permitting or approving a program or activity that uses federal funds. Potential impacts to environmental justice populations include long-term health, environmental, cultural, and/or economic effects. Federally funded programs and projects cannot be denied to environmental justice populations because of cost or physical barriers such as roadways.

To comply with the regulations of Title VI and EO 12898, the environmental and socioeconomic makeup of the study area and the Southern Corridor alternatives was examined. Data were obtained for the study area, including statistics on the state and city level, from the 1990 census for St. George, Hurricane, and Washington City. Data were also gathered for the Southern Corridor alternatives, including the census tracts/block groups within the alternatives. Figure 3-8, Study Area Census Tracts/Block Groups, shows the census tract/block group boundaries with respect to the study area.

The study data include statistics on minority and low-income persons and senior citizens. Although senior citizens are not defined as an environmental justice population according to Title VI and EO 12898, they are considered a vulnerable population (Evans 2001).

3.3.2.1 Minority Populations

Table 3.3-2 shows the minority populations in both the study area and the Southern Corridor alternatives. The study area and the alternatives have a similar percentage of minority populations.

Table 3.3-2. Minority Populations

General Study Area				Southern Corridor Alternatives			
City	Total Persons	Number of Minorities ^a	Percentage of Minorities	Census Tract/Block Group ^b	Total Persons	Number of Minorities	Percentage of Minorities
St. George	28,502	1,349	4.7%	9852-2	2,304	83	3.6%
Hurricane	3,915	206	5.3%	9852-3	1,709	62	3.6%
Washington City	4,198	301	7.2%	9856-2	1,776	91	5.1%
				9856-3	1,092	22	2.0%
				9857-1	3,010	114	3.8%
				9857-2	470	14	3.0%
				9858-2	2,949	169	5.7%
				9860-5	995	25	2.5%
Total	36,615	1,856	5.1%	Total	14,305	580	4.1%

^a Minority populations include Black, American Indian, Eskimo or Aleut, and Hispanic.

^b Census tracts and block groups can encompass a larger area than the specific study area.

Source: U.S. Census Bureau 1990a

3.3.2.2 Low-Income Persons

The median household income in 1989, the most recent year for which data are available, was similar between cities in the general study area but ranged widely among the block groups within the Southern Corridor alternatives (see Table 3.3-3). In general, the census tract/block groups in the Southern Corridor alternatives had a median household income in 1989 nearly equivalent to or greater than the median household income in 1989 for the general study area.

Table 3.3-3. Median Household Income in 1989

General Study Area		Southern Corridor Alternatives	
City	Median Income	Census Tract/ Block Group ^a	Median Income
St. George	\$25,947	9852-2	\$20,530
Hurricane	\$20,323	9852-3	\$19,470
Washington City	\$24,488	9856-2	\$25,234
		9856-3	\$25,086
		9857-1	\$39,212
		9857-2	\$32,500
		9858-2	\$25,865
		9860-5	\$60,000

^a Census tracts and block groups can encompass a larger area than the specific study area.

Source: U.S. Census Bureau 1990a, 1990b

3.3.2.3 Senior Citizens

Demographics. The senior citizen populations in the general study area and the Southern Corridor alternatives are similar, as shown in Table 3.3-4. However, both areas had a higher percentage of senior citizens than the 1990 national average of 12.6%. Senior citizens accounted for 16.3% of the population of Washington County in 1990. Many retirees have relocated to the area due to the mild climate, smaller communities, and natural features.

Table 3.3-4. Senior Citizen Populations

General Study Area				Southern Corridor Alternatives			
City	Total Persons	Number of Senior Citizens ^a	Percentage of Senior Citizens	Census Tract/Block Group ^b	Total Persons	Number of Senior Citizens	Percentage of Senior Citizens
St. George	28,502	5,160	18.1%	9852-2	2,304	365	15.8%
Hurricane	3,915	664	17.0%	9852-3	1,709	308	18.0%
Washington City	4,198	633	15.1%	9856-2	1,776	297	16.7%
				9856-3	1,092	208	19.0%
				9857-1	3,010	430	14.3%
				9857-2	470	56	11.9%
				9858-2	2,949	433	14.7%
				9860-5	995	82	8.2%
Total	36,615	6,457	17.6%	Total	14,305	2,179	15.2%

^a Senior citizens include people age 65 or older.

^b Census tracts and block groups can encompass a larger area than the specific study area.

Source: U.S. Census Bureau 1990a, 1990b

Income. Senior citizens are often part of an environmental justice population based on low income, since senior citizens who are retired and receiving Social Security and Medicare may fall below low income or poverty levels. In 1989, 11.4% of the senior citizen population in the United States was classified as below poverty level (U.S. Census Bureau 2001). Table 3.3-5 indicates that the percentages of senior citizens with an income below poverty level in 1989, in both the general study area and the Southern Corridor alternatives, were smaller than the national percentage of 11.4%.

Table 3.3-5. Impoverished Senior Citizens

General Study Area				Southern Corridor Alternatives			
City	Total Number of Senior Citizens ^a	Number of Impoverished Senior Citizens ^b	Percentage of Impoverished Senior Citizens	Census Tract/Block Group ^c	Total Number of Senior Citizens	Number of Impoverished Senior Citizens	Percentage of Impoverished Senior Citizens
St. George	4,968	282	5.7%	9852-2	342	36	10.5%
Hurricane	610	43	7.1%	9852-3	299	17	5.7%
Washington City	633	81	12.8%	9856-2	265	22	8.3%
				9856-3	233	50	21.5%
				9857-1	386	4	1.0%
				9857-2	87	0	0%
				9858-2	436	31	7.1%
				9860-5	92	0	0%
Total	6,211	406	6.5%	Total	2,140	160	7.5%

^a Total number of senior citizens was based on persons for whom poverty status was determined.

^b Impoverished statuses were determined by income in 1989 below poverty level.

^c Census tracts and block groups can encompass a larger area than the specific study area.

Source: U.S. Census Bureau 1990a, 1990b

Vulnerability. Elderly persons can have conditions that make them vulnerable to the effects of disasters or even relatively minor environmental changes. Sensory deprivation, delayed response, chronic illness, and memory disorders are some of the conditions that increase the vulnerability of some elderly persons (U.S. Department of Health and Human Services 1998). With the relatively high current and anticipated populations of senior citizens in the general study area and the Southern Corridor alternatives, it is important to understand the vulnerability of elderly persons, which is further addressed in Section 4.3, Social Impacts.

3.3.3 Neighborhood and Community Cohesion

Neighborhood and community cohesion is the unity that inhabitants of a common geographic area gain through their common goals, objectives, and close proximity. Cohesion helps a community retain residents and promotes the influx of new residents.

Both large and small communities are found in the study area. The larger communities are the cities of St. George, Washington City, and Hurricane, and the smaller communities are neighborhoods within these cities such as Bloomington Hills, Bloomington Ranches, Sun River, Middleton, Winding River, Sky Ranch, and Cliff Dweller (Hunter 2001). The cities of St. George, Washington City, and Hurricane and all of the smaller neighborhoods are

considered to be cohesive (Hirschi 2001). Leaders of the neighboring cities cooperate with each other. St. George is the largest of these cities and is the main retail and wholesale shopping hub within a 150-mile radius. Over 90% of the goods and services provided to citizens of Washington City and Hurricane come from St. George.

3.3.4 Travel Patterns and Accessibility

The roadways serving as the primary routes through the general study area are:

- I-15, a north-south route through St. George and the surrounding areas
- SR 9, an east-west route that serves as the main connection between I-15, Hurricane, and Zion National Park and provides access to Arizona via SR 59

Section 1.2, Existing Transportation System Linkage, provides an overview of the primary roadways serving the study area.

3.3.5 Public Facilities

The cities of St. George, Washington City, and Hurricane are in the Washington County School District. There are 29 public elementary and secondary schools within the general study area, none of which are located within the Southern Corridor alternatives. The schools closest to the alternatives are Bloomington Elementary, Bloomington Hills Elementary, Desert Hills Intermediate, and one planned high school on the west end of the alternatives; and Hurricane Elementary, Three Falls Elementary, Hurricane Middle, and Hurricane High on the northeast end of the alternatives. Each of these schools is at least 2 to 3 miles from the alternatives (Ferguson 2001).

There are 85 churches in the general study area. Sixty-five are in St. George and 10 are in Hurricane and Washington City. None are located within the Southern Corridor alternatives. The remaining 10 churches are located outside the city boundaries.

The primary hospital facility for St. George and surrounding areas is the Dixie Regional Medical Center, a 137-bed, full-service facility (Greystone 1997b). No medical facilities are located within the Southern Corridor alternatives.

3.3.6 Public Services and Utilities

Local fire and police departments were contacted to determine the existing service conditions for emergency calls.

3.3.6.1 Fire Protection and Ambulance Service

The Washington City and Hurricane Fire Departments receive the majority of their emergency calls from the main city arterials (I-15 and SR 9, respectively). The average emergency response time for the Washington City Fire Department is 3 minutes (Isom 2001). The average emergency response time for the Hurricane Fire Department is about 6 minutes (Campbell 2001). Response time data from the St. George Fire Department were unavailable.

Accessibility to the southern part of each city is not presently a major concern, since the area south of the cities is largely undeveloped. However, with new residential developments and areas of light industry, especially in the Sand Hollow Reservoir area south of Hurricane, the need for greater southern accessibility is increasing (Campbell 2001). In addition, future land use plans for St. George, Washington City, and Hurricane indicate that the southernmost part of Washington County is planned for development and would require additional vehicle transportation routes.

3.3.6.2 Police Protection and Highway Patrol

Currently, the majority of emergency calls to the St. George and Hurricane Police Departments are from the northern (St. George) and eastern (Hurricane) sections of those cities. The average emergency response time for both departments is about 3 minutes (Harding 2001; Excell 2001).

Washington City contracts with the Washington County Sheriff's Office for police services. The majority of the emergency calls to the Washington County Sheriff's Office for the Washington City area are generated within the central part of the city along I-15. The average emergency response time for these calls is less than 12 minutes (Dial 2001).

Accessibility to the southernmost portion of Washington County is provided by I-15. Presently, accessibility relating to law enforcement in this area is not a major concern since the area is mostly undeveloped. However, future land use plans indicate a need for additional accessibility.

3.3.6.3 Utilities

Local utility companies that provide electrical, water, petroleum, telecommunications, sewer, storm drainage, and sanitation services were

contacted to determine whether below-ground or overhead utilities are located within the Southern Corridor alternatives. Two utilities identified major structures within the Southern Corridor alternatives.

The Southern Corridor alternatives are paralleled by a major electrical transmission corridor around Warner Ridge northeast to Willow Springs and separating after Willow Springs. The Dixie Escalante Rural Electric Company provides the electrical service in this area, as well as in the entire area from the Virgin River southeast to the Arizona border.

A water line, power substation, and pump house associated with the Sand Hollow Reservoir are located within the Southern Corridor alternatives southeast of Hurricane.

3.3.7 Quality of Life

Residents of the general study area consider their quality of life to be good. The semidesert climate is characterized by mild winters with average maximum temperatures of 55 to 60 °F and hot summers with average maximum temperatures of 95 to 100 °F. The area has low humidity and minimal precipitation, with an annual average precipitation of 8.30 inches. The topography of the land varies from mountains to sand dunes and provides a vast range of scenery and biological diversity.

The influx of new residents is altering the character of the region from a relatively rural area to a more urbanized one. Many residents are concerned that there has been too much development in St. George and the surrounding areas and feel that the development rate should decrease (Hunter 2001).

3.3.8 Public Health and Safety

The increasing population in the general study area affects the public health and safety on roadways. The American Association of State Highway and Transportation Officials (AASHTO) evaluates the efficiency and safety of roadways by a classification system called level of service (LOS). Many of the main roadways in the general study area are operating at an acceptable level of service (see Chapter 1, Purpose of and Need for Action). However, other roadways such as Bluff Street, St. George Boulevard, and Sunset Boulevard have high traffic volumes and are nearing capacity. Many of the emergency calls to the St. George Police Department are generated from these arterials (Harding 2001).

Other roadways of concern to local residents are the Bloomington interchange at Brigham Road in St. George and the Telegraph Street and SR 9 interchange in Hurricane.

3.3.9 Recreation Resources

Recreation activities in the study area include ATV use, bicycling, and horseback riding. For this section, the study area includes any location where the Southern Corridor would open, limit, or potentially close access to recreation areas. One challenge for future land use planning is maintaining areas for equestrians, bicyclists, hikers, and ATV users. Since open space is declining, participation in certain recreation activities is decreasing. Because the area is undeveloped, little information exists regarding the number of people who use the area for recreation.

The following information was collected primarily through personal interviews with state and federal agencies. Other data were obtained from maps depicting the area's recreational resources. The recreational resources in the study area are shown in Figure 3-9, Recreational Resources. Pedestrian/bicycle facilities are discussed in Section 3.7, Consideration Relating to Pedestrians and Bicyclists.

3.3.9.1 Sand Hollow Reservoir and Recreation Area

The Sand Hollow Reservoir and Recreation Area, currently being built, would enhance existing recreation and introduce new recreation areas for water-based activities, ATV use, equestrian activities, hiking, biking, camping, and other activities. Its establishment will serve as a buffer to urban growth and will help to ensure that Washington County retains its unique recreational opportunities (Utah Division of Parks and Recreation 2001).

3.3.9.2 Designated and Nondesignated Recreation Areas

White Dome. This area shows signs of heavy ATV use. This area is owned by SITLA and is now closed to ATV use, though unauthorized use still occurs.

Warner Ridge/Fort Pearce ACEC. This BLM-administered ACEC is popular for hiking, viewing wildlife, mountain biking, equestrian trail riding, and ATV/OHV use. Parts of the area that contain the endangered bear claw poppy have posted Closed Area signs to limit impacts from ATV/OHV use. In addition, BLM, state, and local law enforcement patrol the area and ticket people who violate the closure restrictions.

Sand Mountain. Sand Mountain is a special recreation management area (SRMA) spanning 40,725 acres. It contains two designations under the BLM's recreation opportunity spectrum: semiprimitive motorized (39,940 acres) and rural location (785 acres) (BLM 1998). This area provides opportunities for formal and informal equestrian, hiking, ATV, and motorcycle use. An ATV tour operator uses the area under a BLM permit. Within this SRMA, the Sand Hollow

Recreation Area will be established to enhance recreation opportunities adjacent to the Sand Hollow Reservoir. The Sand Hollow Recreation Area is on BLM-managed lands.

Most recreation activities occur during the cooler times of the year (HDR 2001b). This area is also known for competitive events such as the annual Rhino Rally Motorcycle Event (authorized under a BLM Special Recreation Permit) and endurance equestrian rides. This area is currently accessed 0.5 mile east of Flora Tech Road, which leads to the north edge of Sand Mountain Area (BLM Recreational Off-Highway Vehicle Brochure, no date).

Dinosaur Track/Fort Pearce Historic Site. The Dinosaur Tracks are located 10 to 15 miles southeast of St. George, Utah, in Warner Valley. There is a fairly large concentration of dinosaur tracks in a sandstone wash marked by BLM signs and an interpretive sign. The Fort Pearce Historic Site contains several pioneer names painted on the north wall of the wash near the fort (BLM Recreational Hiking Brochure, no date). The area also contains Native American rock art and is used for recreation.

Dutchman/Sunshine Loop Trails. These two trails designated for mountain biking are located 10 miles southeast of St. George in Arizona. However, the primary users of these trails are motorcyclists, and the trails are rarely used by mountain bikers. About 500 to 1,000 people use these trails each year (HDR 2001b). Access to these trails is provided from Warner Valley Road.

Anasazi Mountain Men. This is a primitive theme camp set in the early 1800s. Events held there include black powder rifle, pistol, shotgun, and trade gun shooting; knife throwing; lance throwing; bow and arrow shooting; fire-starting contests with flint and steel; and the Mountain Man of the Year contest. Most events last 3 to 10 days and are open to the public on certain days. The Mountain Man event takes place southeast of St. George near Warner Ridge every January on Martin Luther King Day weekend (Big Horn Mountain Men 2001). The St. George/Washington Canal Company authorizes use of the site under a 5-year permit, which expired in 2002.

3.3.9.3 Trails

The three trails in the project area are not clearly marked or defined. Because there is no visible sign of these trails in most places, they must be followed by reading journals of the pioneers. The trails are primarily visited by historians and are rarely visited solely for recreation. The estimated use of all three trails combined is 100 people per year (HDR 2001b).

Honeymoon Trail. This wagon road links St. George with Lee's Ferry on the Colorado River, and from there links to numerous settlements throughout northeastern Arizona. The route was used for over 50 years by young married couples from Arizona seeking a temple marriage in what was then the only Mormon temple west of the Mississippi River (BLM 2001b). The trail is not well-defined in the project area.

Today the trail area is moderately to seldom used by equestrians, hikers, motorcyclists, and ATVs. No fees are required to use the trail. Only the starting point of the trail is marked in Utah, and no further trail markers are present until the crossing of the Utah-Arizona border (Geheardt 2001). Because the trail is not marked in Utah, it is difficult to follow.

Temple Trail. This wagon road of the 1870s links the sawmills of the Mt. Trumbull area to St. George. Much of the rough-milled lumber cut from the Uinkaret Mountains was hauled to St. George to build the Mormon temple there (BLM 2001b). The trail is not well-defined in the project area.

Today the trail area is used by equestrians, hikers, motorcyclists, and ATVs. Only the starting point of the trail is marked in Utah, and no further trail markers are present until the crossing of the Utah-Arizona border (Geheardt 2001). Because the trail is not marked in Utah, it is difficult to follow.

Dominguez-Escalante Trail. The Spanish priests Father Francisco Dominguez and Father Silvestre Escalante may have been the first Europeans to see the Arizona Strip on their expedition in 1776. On foot they traveled from Santa Fe, New Mexico, through western Colorado to Spanish Fork, Utah, and back down through northern Arizona to Santa Fe on this trail. Others crossed the Strip along the Old Spanish Trail during the 1830s and 1840s.

Today the trail area is used by equestrians, hikers, motorcyclists, and ATVs. In 1976, white trail markers were installed to identify the trail; however, many of the markers are missing. Today, the trail is not clearly visible (Geheardt 2001).

3.4 Relocation

If displacement of residences, businesses, or farms is required within the study area, UDOT must comply with the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970, as amended (42 U.S.C. 4601 et seq. as amended, 1989). The Act provides for uniform and equitable treatment of all persons displaced from their homes, businesses, and farms without discrimination on any basis. The guidelines used by UDOT for carrying out the provisions of this Act are contained in its 1997 *Relocation Assistance Brochure*.

3.5 Economics

Economic studies examine the production, distribution, and consumption of commodities and wealth within an area. The discussion of economics is divided into employment, commerce, and tax base.

The study area for this analysis coincides mainly with the Washington County boundary and includes St. George, Hurricane, and Washington City. The following sections provide more detail on the economic makeup of the study area.

3.5.1 Employment

Employment in Utah and the study area is increasing as shown by the drop in unemployment rates. While unemployment rates for Utah and the study area have fluctuated from year to year, general trends show unemployment rates decreasing from 1980 to 2000, as shown in Table 3.5-1.

Table 3.5-1. Unemployment Rates

Year	Utah	Washington County
1980	6.3%	6.4%
1985	5.9%	4.7%
1990	4.3%	4.2%
1995	3.6%	3.3%
2000	3.2%	3.2%
Sources: GOPB 2001; Washington County 2001a		

This increase in employment has coincided with a change in the employment profile for Utah and Washington County, as shown in Table 3.5-2, Employment Percent by Sector in Utah, and Table 3.5-3, Employment Percent by Sector in Washington County. Both Utah and Washington County have experienced a relative increase from 1980 to 2000 in services and nonfarm proprietors and a

relative decrease in agriculture, mining, manufacturing, and government industries. These trends are projected to continue through 2025.

Table 3.5-2. Employment Percent by Sector in Utah

Industry	Percent by Year						
	1980	1990	2000	2005	2010	2020	2025
Agriculture	2.95	2.12	1.47	1.30	1.12	0.88	0.78
Mining	2.77	0.95	0.57	0.50	0.43	0.35	0.33
Construction	4.73	3.09	5.39	4.11	4.33	4.38	4.42
Manufacturing	13.14	11.86	9.90	9.25	8.61	8.06	7.96
Transportation, communications, and public utilities	5.11	4.68	4.48	4.42	4.32	4.29	4.33
Trade	19.28	19.10	18.72	18.10	17.74	17.45	17.46
Finance, insurance, and real estate	3.86	3.78	4.32	4.22	4.14	4.06	4.04
Services ^a	15.86	20.59	22.76	22.76	25.84	27.03	27.33
Government	18.72	16.68	13.63	13.63	13.36	13.03	12.79
Nonfarm proprietors	13.58	17.14	18.76	19.79	20.11	20.48	20.57

^a Includes private households and agricultural services employment

Source: GOPB 2001

Table 3.5-3. Employment Percent by Sector in Washington County

Industry	Percent by Year						
	1980	1990	2000	2005	2010	2020	2025
Agriculture	4.86	2.24	1.04	0.82	0.65	0.44	0.37
Mining	0.75	0.51	0.35	0.36	0.38	0.39	0.38
Construction	5.79	4.87	8.24	7.32	7.23	7.21	7.22
Manufacturing	7.53	7.57	5.17	5.26	4.90	4.59	4.51
Transportation, communications, and public utilities	2.49	4.21	3.73	3.69	3.61	3.61	3.64
Trade	20.88	21.40	22.07	21.21	20.74	20.38	20.41
Finance, insurance, and real estate	4.40	2.51	2.93	2.85	2.79	2.71	2.69
Services ^a	10.82	18.60	19.52	20.12	20.98	21.80	22.02
Government	18.18	12.97	10.75	10.84	10.97	10.91	10.76
Nonfarm proprietors	24.30	25.12	26.19	27.52	27.75	27.95	28.00

^a Includes private households and agricultural services employment

Source: GOPB 2001

The number of new businesses in the study area illustrates the growth in employment. For example, a new WalMart Supercenter employing about 600 workers opened in Washington City in June 2001. An Albertson's grocery store and Home Depot also recently opened in Washington City (Hirschi 2001). A new Target store opened in St. George in July 2001 and a new Lowe's Home Improvement store opened in the St. George area in May 2001 (State of Utah, Department of Workforce Services 2001). Table 3.5-4 lists the 10 major employers in Washington County, of which 7 are located in the study area.

Table 3.5-4. Largest Employers in Washington County

Employer	Number Employed
Washington County School District ^a	1,000–1,999
WalMart ^a	700–999
Dixie Regional Medical Center ^a	700–999
Dixie College ^a	500–699
St. George City ^a	400–499
Lin's Thriftway ^a	200–299
Harmon City	200–299
Andrus Trucking ^a	200–299
Skywest Airlines	200–299
Moore Business Forms	200–299
^a Located within the St. George, Hurricane, Washington City study area	
Source: Washington County 2001b	

3.5.2 Commerce

Washington County had the fifth highest value of taxable retail sales of all counties in Utah and accounted for about 3.8% of the total taxable retail sales in 2000 for the state, which totaled \$31.6 billion. The four counties that had higher taxable retail sales for 2000 are those in the Wasatch Front region: Salt Lake, Utah, Davis, and Weber.

3.5.2.1 Commercial Business Adjacent to I-15

I-15 has five interchanges within the study area: three in St. George, one in Washington City, and one in Hurricane. Several commercial properties are located near I-15 interchanges, as listed in Table 3.5-5. Although no specific data are available, some community leaders and local business owners have stated that some of their business comes from traffic that travels through St. George on I-15 and stops to shop, eat, purchase fuel, or stay overnight on their way to another destination such as Las Vegas or Zion National Park.

Table 3.5-5. Commercial Properties Located near I-15 Interchanges

Interchange	Justification	Retail	Hotels	Personal Services	Museums/ Membership Organizations	Health Services	Miscellaneous	Total Commercial Properties
SR 34, St. George Boulevard	St. George	11	3	0	0	1	0	15
SR 18, Bluff Street	St. George	5	4	0	1	0	0	11
Bloomington	St. George	6	0	1	0	0	0	7
SR 212, Middleton Drive	Washington City	6	0	0	0	0	1	7
SR 9	Hurricane	1	0	0	0	0	0	1

Commercial properties listed are within about two blocks of I-15.
Sources: Nolan 2001; Stokes 2001

3.5.3 Tax Base

3.5.3.1 Property Tax Revenues

Property tax revenues for Utah and Washington County are shown in Table 3.5-6. Of the 29 counties in Utah, Washington County was ranked sixth highest for total real property revenues and seventh highest for total personal property revenues.

Table 3.5-6. Property Tax Revenues

Revenue Source	State of Utah	Washington County	Proportion of State Revenues
Total real property	\$1,028,215,796	\$43,208,034	4.2%
Total personal property	\$101,611,655	\$2,250,892	2.2%

Source: Utah State Tax Commission 2001

3.5.3.2 City Tax Revenues

The tax base for each city within the study area is made up of sales tax, property tax, franchise taxes, road funds, charges and services, interest earnings, building permits, fines and forfeitures, licenses and permits, sale of fixed assets, and other minor sources. Table 3.5-7 shows the general sources of revenue for each city.

Table 3.5-7. City Tax Revenues, Fiscal Year Ending June 2001

Revenue Source	St. George	Hurricane	Washington City
Total sales tax	\$8,538,437	\$878,443	\$1,173,104
Total property tax	\$4,798,994	\$609,268	\$463,592
Other major sources ^a	\$9,200,291	\$1,654,715	\$1,119,393
All other sources	\$3,405,629	\$419,527	\$766,640
Total revenue	\$25,943,351	\$3,561,953	\$3,522,729

^a Other major sources include franchise taxes, road funds, charges and services, interest earnings, building permits, fines and forfeitures, licenses and permits, and sale of fixed assets.

Sources: Hurricane City 2001; Peterson 2001; Utah State Tax Commission 2001; Washington City 2001

3.6 Joint Development

This section discusses proposed recreation and public works projects that might be developed jointly within the study area. The main joint development opportunity consists of a regional network of trails being cooperatively planned between federal, state, and local agencies and organizations. These joint development opportunities relating to pedestrian/bicycle trail systems in the study area are covered in Section 3.7, Consideration Relating to Pedestrians and Bicyclists. The opportunity to develop them jointly with the Southern Corridor project is discussed in Section 4.6, Joint Development Impacts.

The BLM noted in the St. George Field Office Resource Management Plan that they will work with UDOT, Washington County, and project sponsors to identify a suitable route for the Southern Corridor (BLM 1998).

3.7 Consideration Relating to Pedestrians and Bicyclists

This section identifies current and proposed facilities in the study area. This information was collected through city and county planning staff, review of local and regional master plans, the BLM, and the *Dixie Resource Area Proposed Resource Management Plan and Final EIS*. As indicated in Section 3.6, Joint Development, there are opportunities to jointly develop facilities for pedestrian and bicycle trails in connection with the Southern Corridor. All facilities are shown in Figure 3-10, Pedestrian and Bicycle Trails.

3.7.1 Existing Facilities

The Washington County Regional Trails Cooperative Master Plan includes a multi-jurisdictional, Washington county-wide integrated nonmotorized trail system. Federal, state, local government, and private sector entities have

collaboratively planned for a system of multipurpose nonmotorized trails that link communities and special areas across Washington County. Segments of this trail system have already been completed on BLM-managed public lands and within municipal areas such as Santa Clara, St. George, and Hurricane.

Community Trails. As part of the Washington County Regional Trails Cooperative, an extensive number of community trails already exists throughout the Santa Clara, St. George, and Hurricane areas, primarily north and west of the Virgin River. The trail system is composed of both paved and natural-surface trails that accommodate a wide range of users. Some of the existing community trails under the jurisdiction of St. George Parks and Trails Division include the Bluff Street Trail, Fort Pearce Trail, Halfway Wash Trail, and Snow Canyon Trail.

Additionally, many community trails have been developed on BLM-managed public lands, such as those in the Red Cliffs Desert Reserve area. In the Red Cliffs area, the “Lowland Zone,” which makes up about 50% of the reserve, allows nonmotorized travel on designated trails only.

Three Rivers Trail. This trail is a cooperative effort linking people with places in Washington County by creating a system of parks and trails throughout scenic lands, along waterways, between historic sites, and at other places of interest. One existing part of the Three Rivers Trail is the Virgin River trail.

Virgin River Trail. This trail starts just south of Bloomington Hills Country Club off Man of War Road and ends at River Road just northeast of Cox State Park (Kiel 2001). The trail runs along the west side of the Virgin River and can be used for nonmotorized travel.

3.7.2 Proposed Facilities

While the community trails currently exist for recreational use, the future system will also provide alternative transportation. As part of the Washington County Regional Trails Cooperative Management Plan, major population centers throughout Washington County will be linked by the trail system. A number of these trails are planned on BLM-managed public lands, such as those in the Coral Canyon area and between St. George and Hurricane, as well as additional planned trails in the Santa Clara River Reserve area.

Virgin River Phase II Trail. This trail is proposed to start where the current Virgin River Trail ends at River Road just northeast of Cox State Park and would run northeast along the west side of the Virgin River (Kiel 2001).

Bloomington South Trail. This trail is proposed to start north of the Bloomington interchange where the Virgin River crosses under I-15. The trail

would run on the east side of the Virgin River and terminate at Man of War Road (Kiel 2001).

Virgin River South Trail. This trail is proposed to start at the intersection of River Road and the Virgin River. The trail would continue south following the east side of the river and would terminate near St. James Lane (Kiel 2001).

High Desert Trail. Federal and state land-managing agencies, as well as county and local municipality representatives in Washington County, are evaluating a proposed OHV trail system that would provide a linked trail through major areas of southern Utah. The proposed trail would use a network of existing roads and trails in the western part of the county. However, linkages from the High Desert Trail system to other trail systems and recreation areas are also planned.

3.8 Air Quality

Air quality in a given area is a function of the area itself (size and topography), the prevailing weather patterns (meteorology and climate), and the pollutants released. Air quality is described in terms of the concentrations of various pollutants in a given area of atmosphere. For this EIS, the study area for air quality includes Washington County. Since southern Utah is in attainment, no air pollution control district has been established that defines the air basin. The discussion below focuses on the pollutants evaluated, the current air quality standards, and the status of air quality in the study area.

Pollutants. Major air pollutants of concern are carbon monoxide (CO), particulate matter, ozone (O₃), nitrogen oxides (NO_x), and volatile organic compounds (VOCs).

- CO, emitted by vehicle engines, reduces the amount of oxygen carried in the bloodstream.
- Particulate matter of concern is generally that with a diameter of 10 microns or less (PM₁₀). Sources of particulate matter are vehicle emissions.
- O₃ is a secondary pollutant formed when precursor emissions, NO_x and VOCs, react in the presence of sunlight. O₃ is a major component of photochemical smog.
- NO_x is composed mainly of nitric oxide (NO) and nitrogen dioxide (NO₂). NO is formed in high-temperature combustion processes such as internal combustion engines. When NO reaches the atmosphere, most of it oxidizes and produces NO₂, the brownish component of photochemical smog.

- VOCs, the reactive component of hydrocarbon emissions, are compounds of carbon and hydrogen that react chemically in the atmosphere to produce NO₂ and O₃. Principal sources of VOCs are vehicle exhaust emissions and the evaporation of gasoline from fuel tanks and carburetors.

This study addresses the air pollution from mobile sources—those associated with vehicle operations.

Climate. The study area has an arid, temperate climate, characterized by moderately long, hot summers and mild winters. Average maximum temperatures for the summer months are between 95 and 101 °F. There are two rainfall seasons, early spring and late summer, with an average of 8 inches of annual precipitation. Winter precipitation is generally in the form of infrequent traces of snowfall that rarely stay on the ground for more than a day.

Winds in the project area are typically from the west-southwest to the south-southwest. Winds in the area are calm 86% of the time and between 13 and 18 mph 11% of the time. Temperature inversions are common in Utah, especially in fall and winter months, and can lead to buildup of smoke and haze in valleys. This is a more severe problem in northwest Utah, where there are true basins without a drainage outlet for cool air, which tends to pool in the air basins. The southwest area of Utah has the lowest elevations in the state (2,500 to 3,500 feet above sea level), and this area drains to the Colorado River to the south, which tends to limit the strength of inversions in the area.

3.8.1 National Ambient Air Quality Standards (NAAQS)

National Ambient Air Quality Standards include primary national standards to protect public health and secondary standards to protect public welfare (such as protecting property and vegetation from the effects of air pollution). These standards, set by EPA, have been established as the official ambient air quality standards for Utah. For the pollutants addressed in this study, the primary and secondary standards are the same. Current NAAQS are listed in Table 3.8-1.

Table 3.8-1 also lists new NAAQS that have been established for PM_{2.5} (particulate matter 2.5 microns in diameter or less) and for O₃ averaged over an 8-hour period. As these new standards are gradually implemented, EPA will issue guidance for air quality analysis of these pollutants and will designate geographic areas as either attainment or nonattainment with respect to these standards.

Table 3.8-1. National Ambient Air Quality Standards (NAAQS)

Pollutant	National (EPA) Standard ^a	
	Primary	Secondary
Total Suspended Particulates		
Annual Geometric Mean	(no standard)	(no standard)
24-Hour Average	(no standard)	(no standard)
Lead (Pb)		
Quarterly Average	1.5 µg/m ³	1.5 µg/m ³
Particulate Matter (PM₁₀)		
Annual Arithmetic Mean	50 µg/m ³	50 µg/m ³
24-Hour Average	150 µg/m ³	150 µg/m ³
Particulate Matter (PM_{2.5})		
Annual Arithmetic Mean	15 µg/m ³	15 µg/m ³
24-Hour Average	65 µg/m ³	65 µg/m ³
Sulfur Dioxide (SO₂)		
Annual Average	0.03 ppm	(no standard)
24-Hour Average	0.14 ppm	(no standard)
3-Hour Average	(no standard)	0.50 ppm
1-Hour Average	(no standard)	(no standard)
Carbon Monoxide (CO)		
8-Hour Average	9 ppm	9 ppm
1-Hour Average	35 ppm	35 ppm
Ozone (O₃)		
8-Hour Average	0.08 ppm	0.08 ppm
1-Hour Average ^b	0.12 ppm	0.12 ppm
Nitrogen Dioxide (NO₂)		
Annual Average	0.05 ppm	0.05 ppm
Annual standards are never to be exceeded. Short-term standards are not to be exceeded more than 1 day per calendar year unless noted otherwise.		
ppm = parts per million		
PM ₁₀ = particulate matter 10 microns in size or less		
PM _{2.5} = particulate matter 2.5 microns in size or less		
µg/m ³ = micrograms per cubic meter		
^a Primary standards are set to protect public health. Secondary standards are based on other factors (for example, protection of crops and materials, avoidance of nuisance conditions).		
^b Standard is not to be exceeded more than 1 day per calendar year.		
Source: UDAQ 1997		

3.8.2 Study Area Air Quality Status

There has been limited monitoring of air quality in the study area. Currently, air quality in the study area is generally good because of the low population and few large industrial emission sources. The Utah Division of Air Quality obtained some air quality monitoring data in St. George at 200 E. Tabernacle Street from 1995 through 1998 (UDAQ 2002). These data, summarized in Table 3.8-2, indicate that maximum concentrations were below their associated NAAQS.

Table 3.8-2. Summary of Air Quality Monitoring Data for St. George

Pollutant	Year	Averaging Period	Observation Period	Maximum Average Period Concentrations	NAAQS
Ozone (O₃)	1995	1-hour	1,600 hours	0.078 ppm	0.12
	1996	1-hour	3,227 hours	0.086 ppm	
	1997	1-hour	3,093 hours	0.083 ppm	
Particulate Matter (PM₁₀) 24-Hour	1995	24-hour	69 days	82 µg/m ³	150
	1996	24-hour	161 days	85 µg/m ³	
	1997	24-hour	158 days	49 µg/m ³	
	1998	24-hour	29 days	43 µg/m ³	
Particulate Matter (PM₁₀) Annual	1995	Annual	69 days	35 µg/m ³	50
	1996	Annual	161 days	25 µg/m ³	
	1997	Annual	158 days	22 µg/m ³	
	1998	Annual	29 days	19 µg/m ³	
Carbon Monoxide (CO)	1995	8-hour	1,455 hours	4 ppm	9.0
	1996	8-hour	3,559 hours	3 ppm	
	1997	8-hour	1,582 hours	4.9 ppm	

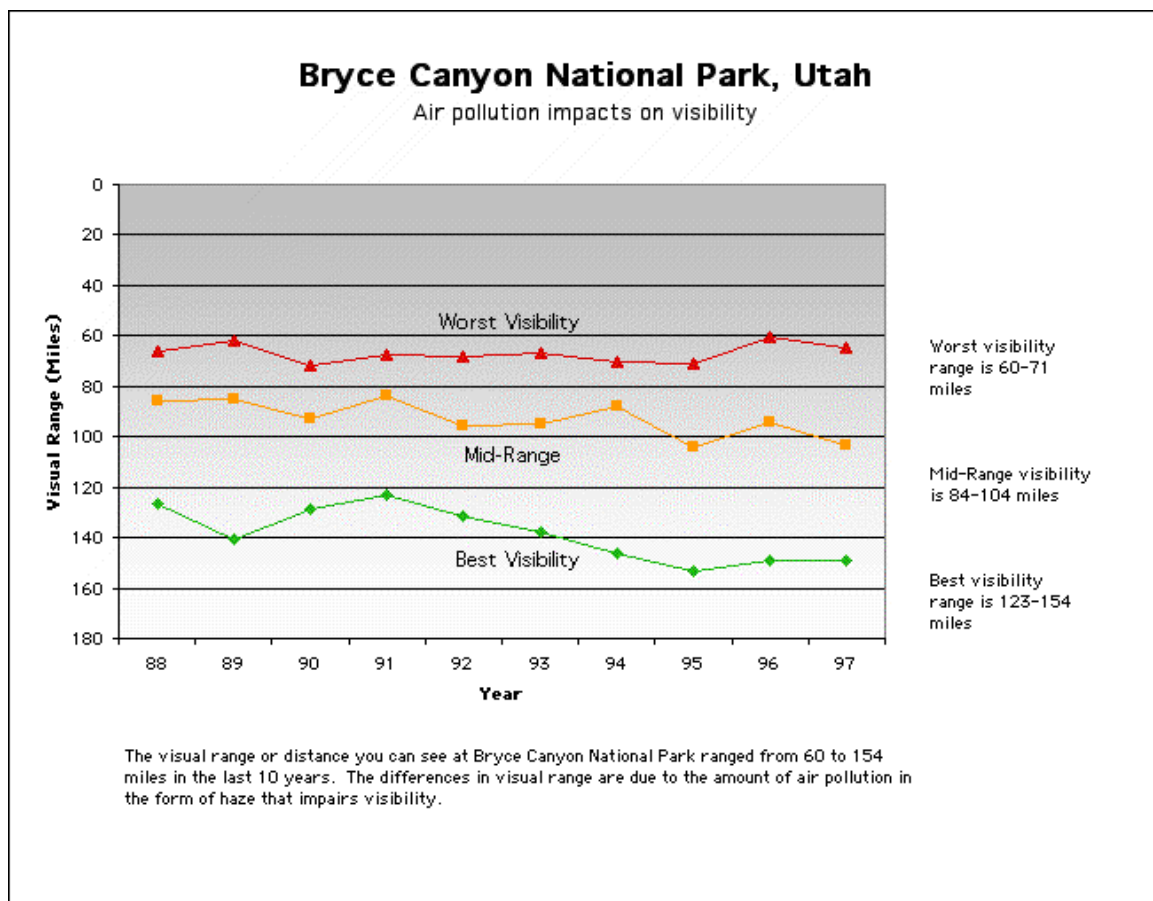
With respect to NAAQS, all of Washington County as well as the adjacent areas of Mohave County, Arizona, are classified as either “attainment” or “unclassified,” meaning that air pollutant monitoring data sufficient to determine pollutant levels are not available. Unclassified areas are treated as attainment when applying air pollution control regulations. The nearest areas that do not meet NAAQS are parts of Clark County, Nevada, about 90 miles southwest of the study area, which do not meet standards for PM₁₀.

Zion National Park, about 15 miles northeast of the study area, is designated as a Class I area under Prevention of Significant Deterioration rules. These rules allow only small, incremental increases to pollutant levels and establish protection of visibility and other air-quality-related values (BLM 1998).

Visibility impacts in the park are a concern due to the potential growth of the St. George area. Currently, not enough visibility monitoring data are available to establish trends for Zion National Park. Only 1 year of observations are available, and these were collected at the northwest boundary of the park near the edge of the I-15 ROW.

However, visibility monitoring data have been collected at Bryce Canyon National Park, about 60 miles northeast of the project area (EPA 2002a). These data, presented in Table 3.8-3, show that visibility on average and best visibility days improved slightly over the 10 years of monitoring from 1988 to 1997. On the worst visibility days, there is no apparent trend in visibility during this period.

Table 3.8-3. Visibility Trends for Bryce Canyon National Park



3.8.3 Study Area Existing Pollutant Emissions

Existing air pollutant emissions in the study area are relatively low, due to the limited level of development and the lack of any large industrial emission sources. An inventory of baseline emissions for 1994 is provided in Table 3.8-4. Washington County's total emissions are based on EPA's emissions trends data set (EPA 2002b). The project area highway network emission estimates are based on project area traffic data combined with emission factors generated using the EPA computer programs PART5 (EPA 1994) and MOBILE5b (EPA 1995) for the average estimated highway speed of 40.4 mph. These data show that 1994 highway vehicle emissions of the various pollutants represented from 1% of total Washington County emissions for PM₁₀ to 37% of Washington County emissions for NO_x.

Table 3.8-4. 1994 Project Area Existing Emissions

Pollutant	St. George Area Highway Network Vehicle Emissions		Washington County Total Emissions		Percent of County Total
	Factor (g/VMT)	Total (tons/day)	Tons/Day	Tons/Year	
Carbon monoxide (CO)	23.61	21.8	67.3	24,561	31%
Nitrogen oxides (NO _x)	3.06	2.8	7.5	2,723	37%
Particulate matter (PM ₁₀)	0.37	0.3	29.0	10,587	1%
Sulfur dioxide (SO ₂)	0.12	0.1	0.6	218	17%
Volatile organic compounds (VOCs)	3.69	3.4	9.7	3,542	35%

3.9 Noise

This section describes the existing noise environment in the study area. The study area is defined as the land adjacent to the proposed Southern Corridor alignments that could be affected by an increase in noise from the new highway. To provide a general context of the noise environment, a regional overview is also provided. This section also describes the general characteristics of noise, a regulatory overview of noise standards, what sensitive noise receptors exist in the study area, and monitored noise levels.

3.9.1 Characteristics of Noise

Noise is defined as unwanted sound. The decibel (dB) is the accepted standard unit for measuring noise. Since human hearing is not equally sensitive to all sound frequencies, only certain frequencies can be considered when measuring in decibels. The A-weighted decibel scale corresponds to the sensitivity range for

human hearing; noise levels for this scale are measured in dBA. A noise level change of 3 dBA is barely perceptible to humans, but a 5-dBA change is noticeable. A 10-dBA change in noise is perceived as a doubling of noise loudness, while a 20-dBA change is considered a dramatic change. Table 3.9-1 shows noise levels associated with everyday sources.

Table 3.9-1. Weighted Sound Levels and Human Response

Examples of Sound Sources	dBA ^a	Response Criterion
	0	Threshold of hearing
	10	Just audible
Broadcasting studio background	20	
Soft whisper at 15 feet	30	Very quiet
In living room, bedroom, or library background	40	
	50	Quiet
Air conditioner at 20 feet; light auto traffic at 50 feet	60	
Freeway traffic at 50 feet	70	Intrusive; telephone use difficult
Passenger train at 100 feet; freight train at 50 feet; helicopter at 500 feet	80	Annoying
Heavy truck at 50 feet; pneumatic drill at 50 feet	90	Hearing damage after 8 hours
Shout at 0.5 foot; inside New York subway station	100	Very annoying
Riveting machine; jet takeoff at 2,000 feet	110	
Jet takeoff at 200 feet; auto horn at 3 feet; inside discotheque	120	Threshold of feeling and pain
	130	Painfully loud
Carrier deck jet operation	140	Limit of amplified speech

^a Typical A-weighted sound levels taken with a sound-level meter and expressed as decibels (dBA) on the "A" scale, which approximates the frequency response of the human ear.

Source: CEQ 1970

3.9.2 Regulatory Overview

Equivalent Sound Level. Federal regulatory agencies often use the equivalent sound level (L_{eq}) scale to evaluate noise impacts (EPA, 40 CFR [Code of Federal Regulations] 201 to 211), where noise is defined as a constant sound with the same sound energy as a more realistic, fluctuating sound. When reporting sound levels, it is crucial to identify the time period under consideration. $L_{eq}(24)$, for example, is the equivalent sound level for a 24-hour period. Unless otherwise noted, all sound levels provided in this report use $L_{eq}(1)$, the hourly equivalent noise level.

Federal Highway Administration Noise Standards. The Federal Noise Control Act of 1972 (EPA, 40 CFR 201 to 211) requires that all federal agencies adminis-

ter programs in a manner that promotes an environment free from noise that may jeopardize public health or welfare. FHWA has adopted criteria for evaluating noise impacts associated with federally funded highway projects. If the impacts are sufficient, they could justify funding for mitigation (FHWA, 23 CFR 772).

FHWA noise abatement criteria are based on peak-hour L_{eq} noise levels. The peak-hour L_{eq} criterion for permissible noise levels in residential, educational, and healthcare facilities is 67 dBA outdoors. The peak 1-hour L_{eq} criterion for commercial and industrial areas is 72 dBA outdoors. The FHWA noise abatement criteria are summarized in Table 3.9-2.

Table 3.9-2. FHWA Noise Abatement Criteria

Activity Category	L_{eq} Noise Levels	Description of Activity Category
A	57 dBA (exterior)	Lands on which serenity and quiet are of extraordinary significance and serve an important public need, and where the preservation of those qualities is essential if the area is to continue to serve its intended purpose
B	67 dBA (exterior)	Picnic areas, recreation areas, playgrounds, active sports areas, parks, residences, motels, hotels, schools, churches, libraries, and hospitals
C	72 dBA (exterior)	Developed lands, properties, or activities not included in above categories
D	—	Undeveloped lands, dispersed recreation activities
E	52 dBA (interior)	Residences, motels, hotels, public meeting rooms, schools, churches, libraries, hospitals, and auditoriums

Source: FHWA 1982

Utah State Guidelines. The UDOT Noise Abatement Policy 08A2-1 (UDOT 08A2-1) was adopted November 6, 1987, and revised April 20, 2000. UDOT Policy 08A2-1 establishes policies and procedures for conducting traffic noise studies, coordinating within UDOT, involving the public (including local government agencies), and approving mitigation measures. The policy is consistent with FHWA, 23 CFR 772 and Utah Code 72-6-111 and 72-6-112.

Under UDOT Policy 08A2-1, the proposed Southern Corridor project is considered a Type I project, defined as construction of a highway at a new location or a physical alteration of an existing highway that substantially changes the alignment or increases the number of through-traffic lanes. According to UDOT Policy 08A2-1, a traffic noise impact occurs when either of the following conditions occurs at a sensitive land use (such as a school or hospital):

1. The design noise level equals or exceeds 67 dBA, or
2. The design noise level exceeds the existing noise level by 10 dBA or more.

3.9.3 Existing Noise Levels

The majority of the study area consists of isolated desert conditions. Background noise levels in these areas are from wind and blowing sand. A few sparsely located residences, FHWA Activity Category B, make up the few sensitive receptors. These residences are located near monitoring sites 1, 2, 7, and 8 as shown in Figure 3-11, Southern Corridor Noise Monitoring Locations.

To determine existing noise levels, measurements were taken at 11 locations throughout the study area (see Figure 3-11). The associated noise levels at each monitoring location are provided in Table 3.9-3.

Table 3.9-3. Ambient Noise Monitoring Data

Monitoring Site ID	FHWA Category	Location	Monitored L_{eq} (dBA)
1	B	Near existing residences along all proposed alternatives at proposed Redhawk subdivision. Mostly undeveloped except for several residences.	46
2	B	Near existing residences and proposed 3400 West Alternative on Flora Tech Road. Mostly undeveloped land except for a few residences.	58
3	D	South of intersection of SR 9 and proposed 2800 West Alternative. Area is undeveloped.	60
4	D	At intersection of proposed 3400 West Alternative and 2800 West Alternative. Area is undeveloped.	52
5	D	Located 1,000 feet southeast of River Road near Utah-Arizona border along all proposed alternatives. Area is undeveloped.	62
6	D	Near Warner Ridge along all proposed alternatives. Area is undeveloped.	62
7	B	Southern end of proposed 4300 West Alternative. Mostly undeveloped farmland except for several residences.	61
8	B	At SR 9 and 4300 West, intersection of proposed 4300 West Alternative. South side of SR 9 at monitoring location is undeveloped. North side of SR 9 includes trailer park and gas station.	67
9	D	On 3400 West Alternative, north of proposed Dixie Springs subdivision. Area is undeveloped.	42
10	D	Northwest of intersection with Fort Pearce Wash. Area is undeveloped.	34
11	D	South of the proposed Sand Hollow Reservoir along proposed 2800 West Alternative. Area is undeveloped.	34

All monitored levels are below the FHWA criteria of 67 dBA for residences, except the monitoring site next to SR 9 that equals the noise abatement criteria. Other noise monitoring sites were located in rural desert locations where noise levels were usually below 50 dBA; however, wind blowing during monitoring might have caused the readings above 60 dBA.

3.10 Water Quality

This section describes the existing condition of surface water and groundwater in the study area. For this analysis, the study area generally includes the Virgin River basin for surface water and groundwater sources next to the proposed Southern Corridor alternatives.

3.10.1 Water Quality Regulations

Water quality is regulated by the 1977 Clean Water Act (CWA), also known as the Federal Water Pollution Control Act. The CWA is the primary federal law that protects our nation's waters, including lakes, rivers, aquifers, and coastal areas, by:

- Requiring major industries to meet performance standards to ensure pollution control,
- Charging states and tribes to set specific water quality criteria appropriate for their waters and develop pollution control programs to meet these criteria, and
- Regulating the discharge of dredge or fill material into waters of the U.S.

The following three sections of the CWA apply to the Southern Corridor project:

- Section 401, State Water Quality Certification
- Section 402, National Pollutant Discharge Elimination System (NPDES) Permits
- Section 404, Permit for Placing Fill in Waters of the U.S.

EPA is the regulatory authority for Sections 401 and 402 of the CWA. In July 1987, EPA delegated portions of this authority to the Utah Department of Environmental Quality (UDEQ).

UDEQ implemented the Utah Water Quality Act and classified surface waters in Utah into beneficial use classifications. Each classification has an associated numerical standard. The narrative standard is as follows:

It shall be unlawful, and a violation of these regulations, for any person to discharge or place any waste or other substance in such a way as would be or may become offensive such as unnatural deposits, floating debris, oil, scum, or other nuisances such as color, odor, or taste; cause conditions which produce undesirable aquatic life or which produce objectionable taste in edible aquatic organisms; or result in concentrations or combinations of substances which produce undesirable physiological responses in desirable resident fish, or other desirable aquatic life, or undesirable human health effects, as determined by

bioassay or other tests performed in accordance with standard procedures (Utah Administrative Code, Rule R317-2-7).

To be safe for intended uses, the quality of surface waters should not exceed the established standards. UDEQ's goal is to ensure that a project does not cause the quality of the receiving waters to degrade such that the numerical standards are exceeded. UDEQ gives additional protection to maintain "high-quality" waters. There are no high-quality waters in the study area. For any activity that could result in a discharge of pollutants into a body of water, UDEQ must certify that the proposed activity will not violate state or federal water quality standards. If the project is in compliance, UDEQ issues a Section 401 Water Quality Certification.

The U.S. Army Corps of Engineers (COE) is the issuing agency for Section 404 permits regulating wetlands, streams, lakes, and other U.S. waters. Under Section 404(c), EPA has ultimate veto authority over 404 permits.

Runoff to surface water is regulated through the Utah Pollutant Discharge Elimination System (UPDES) program. Projects that disturb more than 1 acre must have a UPDES permit for construction activities to legally proceed, which would include provisions to minimize water quality impacts from storm water runoff.

3.10.2 Water Quality of Surface Conveyances

3.10.2.1 Dry Washes

The study area contains dry washes, identified by a defined bed, bank, and evidence of scour. The washes vary from narrow, unvegetated channels to wide, flat-bottomed channels with heavy deposits of gravel and cobble. The banks of some channels are vegetated with hydrophilic (water-loving) trees and shrubs such as willows and tamarisks. These channels are dry for the majority of the year except during periods of precipitation, such as summer thunderstorms and occasional snowmelt. Seasonal and ephemeral streams are common terms associated with these channels.

Figure 3-12, Water Resources, shows several of the larger washes and watercourses found near the study area. The Fort Pearce Wash is the main collector channel for the southern part of the study area, and is about 250 feet wide near where it would cross the Southern Corridor alternatives. The channel has several meanders, but where it crosses the study area flows are north to northwest. The Fort Pearce Wash drains an area of over 1,000,000 acres, and large flood flows can be expected during heavy rain (USGS 1997). The Atkinville Wash is another relatively large wash that flows to the northwest,

located in the southwest part of the study area near I-15. Two additional named washes, the Mokaac and the Lizard, join the Atkinville Wash near I-15.

3.10.2.2 Virgin River

The Virgin River Basin consists of about 1,831,000 acres, spanning from where it crosses the Utah-Arizona state line south of St. George to its origins in the Cedar and Pine Valley mountain ranges in the Dixie National Forest. Water in the Virgin River comes from surface runoff from rainfall and snowmelt and from the groundwater entering the channels through springs during late summer and fall. Snowmelt makes up the largest portion of the annual stream flow, though high flows can be expected during heavy rain.

Water Quality

The UDEQ beneficial use classifications for the Virgin River are:

- 2B: protected for secondary contact recreation
- 3B: protected for warm-water species of game fish
- 4: protected for agricultural uses (UAC [Utah Administrative Code] R317-2-13)

The Atkinville and Fort Pearce Washes are not classified by UDEQ. The default classifications are 2B and 3D (protected for waterfowl, shorebirds, and other water-oriented wildlife including the necessary organisms in their food chain).

EPA maintains water quality data in its STORET database. Water quality data exist for the Virgin River and the Fort Pearce Wash. These data are limited to seven sampling events from the Fort Pearce Wash (collected from January to June 1997) and the Virgin River (collected from February 1998 to June 2000). Samples from the Fort Pearce Wash were collected near where it meets the Virgin River. Samples from the Virgin River were collected west of Hurricane and near Bloomington.

Table 3.10-1 summarizes the existing water quality of the Virgin River and the Fort Pearce Wash. The chronic UDEQ standards listed are typically 4-day average concentrations and the acute standards are generally 1-hour average concentrations. The minimum dissolved oxygen (DO) chronic and acute numeric standards are minimum allowable concentrations and are for a 30-day average and a 1-day average, respectively. The values for temperature, dissolved solids, iron, and phosphorous are the maximum allowable concentrations. The constituents that do not meet their numeric criteria, based solely on the statistical parameters presented, are listed in bold in Table 3.10-1.

Table 3.10-1. Existing Water Quality Data

Constituent	Virgin River			Fort Pearce			UDEQ Criteria for Aquatic Wildlife	
	Average	Min.	Max.	Average	Min.	Max.	Chronic	Acute
Minimum Dissolved Oxygen (mg/L)	9	5.1	14.3	8.1	6.4	9.7	5.5	5.0/3.0 pH
Turbidity Increase (NTU)	663	2	9,100	153	46	490	10	10
Temperature (°C) Max.	15.9	4.5	31	16.1	9.7	22.1	27	27
Hardness (mg/L)	683	289	1,751	687	402	1,216	NS	NS
Specific Conductance (uohms/cm)	2,125	716	3,499	1,990	200	3,052	NS	NS
Dissolved Solids (mg/L)	1,399	492	2,258	1,446	788	2,184	1,200	1,200
Suspended Solids (mg/L)	1,228	22	25,450	486	78	2,356	90	90
Calcium	190.7	77	629	192.1	110	372	NS	NS
Chloride	349.8	62	600	272.1	147.5	475	NS	NS
Metals								
Aluminum	0.018	< 0.030	0.049	< 0.030	< 0.030	< 0.030	0.087	0.75
Arsenic	0.012	< 0.005	0.025	0.005	< 0.005	0.0075	0.19	0.36
Barium	0.084	0.056	0.17	0.0835	0.076	0.091	NS	NS
Cadmium ^a	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.0011	0.004
Chromium (Hexavalent) ^b	0.003	< 0.005	0.008	< 0.005	< 0.005	< 0.005	0.011	0.016
Copper ^a	< 0.012	< 0.012	< 0.012	< 0.012	< 0.012	< 0.012	0.012	0.018
Iron	0.015	< 0.020	0.053	0.022	0.021	0.024	1	1
Lead ^a	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003	0.0032	0.082
Magnesium	50.4	23.6	80.9	50.5	31	70	NS	NS
Mercury	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	0.000012	0.002
Potassium	19.0	5.3	30.4	14.8	8.4	26.2	NS	NS
Selenium	0.002	< 0.001	0.006	0.0017	0.0011	0.0023	0.005	0.02
Silver ^a	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	NS	0.004
Sodium	234.9	54.7	394.0	188.3	107.0	327.0	NS	NS
Zinc ^a	< 0.030	< 0.030	0.042	< 0.030	< 0.030	< 0.030	0.11	0.12

Constituent	Virgin River			Fort Pearce			UDEQ Criteria for Aquatic Wildlife	
	Average	Min.	Max.	Average	Min.	Max.	Chronic	Acute
Pollution Indicators								
Biological Oxygen Demand (mg/L)	1	0	6	ND	ND	ND	5	NS
Ammonia (mg/L) ^c	0.022	0.000	0.120	0.025	0.000	0.064	1.20	5.68
Nitrate (mg/L) ^d	0.42	0.00	0.63	1.55	0.36	4.61	4	NS
Sulfate (mg/L)	481.0	151.0	1290.4	543.8	253.9	1068.1	NS	NS
Phosphorus as P (mg/L)	0.19	0.00	2.33	0.27	0.02	1.06	0.05	NS
One-half detection limit was used to determine average.								
mg/L = milligrams per liter								
uohms/cm = unit ohms per centimeter								
ND = No data available								
NS = No standard								
^a Hardness-dependent criterion. Numeric standards reported are for a hardness of 100 mg/L.								
^b Total chromium concentrations reported.								
^c Ammonia standard is pH- and temperature-dependent. The standard at pH 8.0 and 15 °C (59 °F) is reported.								
^d Values reported are total nitrogen concentrations as nitrate and nitrite.								

The Virgin River is on Utah's 303 (d) list of impaired waters for consistently exceeding the standard for total dissolved solids (TDS). TDS is a measure of dissolved matter in water. TDS constituents include salts such as chlorides, nitrates, and sulfates; nutrients such as nitrogen and phosphorus; heavy metals such as copper and zinc; and other trace elements. Chloride levels exceed the EPA recommended chronic (4-day average) concentrations of 250 mg/L. UDEQ has not established numeric criteria.

According to Section 303 (d) of the CWA, each state is required to identify those water bodies for which existing water quality does not meet the standards established for its designated beneficial use classification. Once a water body is identified as "water quality limited," the state is required to identify the sources of the water quality problem and assign responsibility for controlling the pollution.

The process of identifying pollution sources and determining pollution reduction strategies is called the total maximum daily load (TMDL) analysis. This process determines:

- The amount of a specific pollutant that a water body can receive without exceeding a water quality standard,
- The distribution of the pollutant amount between point and nonpoint sources (NPS), and
- A margin of safety (UDWQ 2000).

When a state prepares its biannual 303 (d) list, it is required to prioritize the water bodies for TMDL development. According to Jay Pitkin with the UDEQ Division of Water Quality, the Virgin River is not currently a priority for TMDL development (Pitkin 2001). A large source of the TDS loading to the Virgin River is from the Fort Pearce Wash with the majority of its watershed area in Arizona. Arizona is not currently planning a TMDL analysis for this watershed and therefore UDEQ does not have the Virgin River as a priority (Montague 2001).

The *Virgin River Basin—Utah Cooperative Study* was prepared with the Utah Division of Water Resources, U.S. Department of Agriculture, Soil Conservation Service (Dixie and Color Counties), and the Washington County Planning Office as participating agencies. The objective of the Virgin River basin planning study was to explore the potential for water and soil conservation considering development opportunities to protect and better use the resources in the Virgin River basin. One finding of the study is that many water quality problems are a result of soil erosion. Natural erosion levels are high because of low vegetative densities, steep gradients, and unstable substrates. Erosion contributes to an increase in TDS constituents and to increased concentration of trace elements. Wayne Thomas with UDEQ in Washington County also believes that the high TDS levels are from natural sources and the Virgin River needs to be reclassified (Thomas 2001).

When Utah completes the TMDL study for the Virgin River, the study might conclude that the river needs to be reclassified because the existing TDS levels are from natural sources. If local agricultural land is being used for livestock grazing and the Virgin River is being used to water livestock, or if the land use is being altered, it may be necessary to reclassify the river and develop constraints on a site-specific basis. However, until the study is completed, the Virgin River continues to exceed Utah's water quality standards for TDS, total suspended solids (TSS), biological oxygen demand (BOD), and phosphorus, and EPA's standard for chloride.

3.10.3 Groundwater Quality

The groundwater system in the Virgin River Basin consists of two distinct aquifer systems: valley fill and consolidated rock. Groundwater withdrawals from the valley-fill aquifers are used primarily for irrigation, while withdrawals from the deeper consolidated-rock aquifers are used for public drinking water. The main consolidated-rock aquifers are found in Navajo Sandstone and the Kayenta Formation and are referred to as the Navajo and Kayenta aquifers. Navajo Sandstone, which is 2,200 feet thick in some areas, overlies the Kayenta Formation (U.S. Department of Agriculture 1990).

Infiltration of precipitation as either rain or snow is thought to be the largest source for recharging the main aquifer. Recharge from the small amounts of precipitation from summer storms is minimal, since most of the water is intercepted in shallow subsurface aquifers or lost through evapotranspiration. Long-lasting storms or storms of high intensity, especially during the winter months when evapotranspiration effects are minimal, account for the largest percentage of recharge to the deep aquifers.

There are additional sources of groundwater recharge to the aquifers. These include seepage from streams traversing the Navajo Sandstone and Kayenta Formation outcrops, numerous ephemeral washes traversing the outcrops, seepage from overlying and underlying aquifers, and infiltration from unconsumed irrigation water.

The dissolved solids concentration of samples from wells and springs in the Navajo and Kayenta aquifers ranged from 110 to 1,310 mg/L. Groundwater in most of the Navajo and Kayenta aquifers was low in dissolved minerals with an average dissolved solids concentration of about 300 mg/L. There are two distinct areas with dissolved solids concentrations greater than 500 mg/L: a large area north of St. George and smaller area about 5 miles west of Hurricane near Berry Springs. Water samples from wells and springs near these areas had an average dissolved solids concentration of 1,020 mg/L. These elevated levels may be due to hydrothermal upward flow from underlying formations, since groundwater temperatures are also elevated in these areas (USGS 2000b).

3.10.4 Groundwater Rights and Wells

The Water Rights Division of the Utah Department of Natural Resources tracks groundwater rights according to an inventoried water right number. Each water right number represents one or more actual groundwater wells. Wells are classified according to their use and are designated as domestic, irrigation, stock watering, municipal, or recreational. Domestic classification indicates that the water is used for drinking water in a private home or business; municipal classification indicates that the well is owned by a city or county for a variety of uses, including agricultural uses and drinking water. The approximate locations of the well or cluster of wells corresponding to a water right number in the study area are shown in Figure 3-13, Groundwater Well Locations.

Owners of municipal drinking water wells are required to prepare a Drinking Water Source Protection Plan as required by the Drinking Water Source Protection Rule (UAC R309-113). Part one of this plan identifies four distinct protection zones with each zone having different management requirements.

- Zone 1 is the area within a 100-foot radius from the wellhead.
- Zone 2 is the area within a 250-day groundwater time of travel to the wellhead.
- Zone 3 is the area within a 3-year groundwater time of travel to the wellhead.
- Zone 4 is the area within a 15-year groundwater time of travel to the wellhead.

In general, development is not allowed within a designated drinking water protection area unless it can be shown that the withdrawal point is isolated from the surface by a confining layer, or the development would not be a source of contamination. In the north part of the study area, there are six drinking water wells registered with the UDEQ Division of Drinking Water:

- Washington County Water Conservancy District, Sand Hollow Wells #1 and #2
- Hurricane Valley Wells #1 and #2
- Hurricane City, Stratton Well #1 and 27007-003

For security reasons, the specific locations of drinking water wells are not shown in this document.

3.11 Wetlands/Waters of the U.S.

This section describes how wetlands were identified and evaluated and discusses wetland functions. Wetlands were first identified by compiling data from existing studies, NRCS soils information, aerial photography, and field investigations. The study area includes all jurisdictional water along the proposed Southern Corridor.

3.11.1 Methodology

Preliminary identification of jurisdictional waters was performed using aerial photography. Preliminary identifications were verified by field investigations and further data gathering (soils, flood maps, and so on). The field investigations were conducted on May 4, 1999, February 8, 2000, April 25, 2000, August 13–15, 2001, and September 14, 2001. The study area was surveyed to determine the extent of the jurisdictional wetland. The results of the field survey were documented and approved by the U.S. Army Corps of Engineers on October 6, 2000 (Entranco 2000). An addendum to this report was submitted to encompass minor modifications to the alternatives (HDR 2001c).

Wetlands were identified according to routine delineation methods described in the *Corps of Engineers Wetlands Delineation Manual* (U.S. Army Corps of Engineers 1987). The manual uses the three-parameter approach (hydrophilic vegetation, hydric soils, and wetland hydrology) to determine the presence of jurisdictional wetlands. Positive indicators of all three parameters must be present for an area to qualify as a jurisdictional wetland. Waters of the United States, specific to this project, are streams, dry washes/drainages, and wetlands. The jurisdictional wetlands in the study area are shown in Figure 3-14, Jurisdictional Wetlands within Study Area.

3.11.2 Wetlands/Waters of the U.S. Inventory

The jurisdictional waters in the study corridor are 61 seasonal washes/drainages and 2 springs. Each of these jurisdictional waters serves a basic environmental function.

The washes/drainages are seasonal (ephemeral streams) and convey water from precipitation events that create flash flooding. These washes/drainages were identified based on a defined bed and bank and evidence of scouring.

The two primary washes are Atkinville and Fort Pearce. The Atkinville Wash is southwest of the proposed Southern Corridor and I-15 connection and is a fairly large collector for the area. The wash flows northwest, parallel to the proposed Southern Corridor. The Fort Pearce Wash is near the center of the proposed Southern Corridor alternatives and is the main collector channel for this area. The wash flows north across the proposed Southern Corridor.

There are two springs in the project area. Willow Spring emanates from a rock outcrop and flows for about 25 feet before disappearing into the ground. The wet soils have a heavy growth of hydrophilic vegetation. The spring area is relatively small, less than 200 square feet, and is considered to be a jurisdictional wetland.

A human-made spring and wetland, about 10 square feet, exist near SR 9 at 4300 West. The spring was created by a piped water source and was likely used to water cattle.

3.12 Water Body Modification and Wildlife

Many sources were referred to for information on wildlife. UDWR and BLM were consulted for occurrence of state-sensitive and other high-interest wildlife species possibly living in the study area, which is defined as southern Washington County near the proposed Southern Corridor alternatives. Field inventories for vegetation and wildlife were conducted from March to July 1999 and August to October 2001. Field inventory consisted of literature reviews,

aerial photo interpretation, onsite field reconnaissance, quantitative sampling, and field mapping.

3.12.1 Water Bodies

The water bodies in the study area include both surface water and groundwater. The only year-round surface water in the study area is the Virgin River. The remainder consists of dry washes that flow during storm events and two springs (see Section 3.11, Wetlands/Waters of the U.S.). The groundwater system consists of two distinct aquifer systems: the valley-fill aquifers and consolidated-rock aquifers. Section 3.10, Water Quality, provides a detailed description of the water bodies in the study area.

3.12.2 Vegetation

3.12.2.1 Desert Shrub

Warm and cold desert shrub communities converge in the study area. Creosote bush (*Larrea tridentata*) is a warm desert shrub characteristic of the Mojave desert, and big sagebrush (*Artemisia tridentata*) is a cold desert shrub characteristic of the Great Basin desert. Shrubs codominant with creosote include range ratany (*Krameria parvifolia*) and bur sage (*Ambrosia dumosa*). Big sagebrush is codominant with shadscale (*Atriplex confertifolia*), Mormon tea (*Ephedra torreyana*), big rabbitbrush (*Chrysothamnus nauseosus*), and winterfat (*Ceratoides lanata*).

Blackbrush (*Coleogyne ramosissima*), a species occurring in a band straddling the Utah-Arizona border and northeast along the Colorado River, often occurs in pure stands on shallow, sandy soils in the study area.

3.12.2.2 Lowland Riparian Scrub

Lowland riparian scrub is common along the Virgin River and associated floodplains in the study area. The Virgin River is not within the project boundaries, but adjacent floodplains do occur in the study area near Harrisburg Dome. Salt cedar (*Tamarix ramosissima*), sandbar willow (*Salix exigua*), and Emory seepwillow (*Baccharis emoryi*) are common species in the floodplains and shaded mesic washes. Fremont cottonwood (*Populus fremontii*) is often found in sparse stands associated with salt cedar, sandbar willow, and Emory seepwillow near isolated springs, and along the floodplains of the Virgin River.

3.12.3 Fish and Wildlife

3.12.3.1 Fish

Six native fish occur in the Virgin River, including the federally endangered woundfin (*Plagopterus argentissimus*) and Virgin River chub (*Gila seminuda*). The other species, Virgin spinedace (*Lepidomeda mollispinis mollispinis*), desert sucker (*Catostomus discobolus*), speckled dace (*Rhinichthys osculus*), and flannelmouth sucker (*Catostomus latipinnis*), are listed as Utah state species of special concern. The Virgin River proper does not occur within the project boundaries.

3.12.3.2 Large Mammals

Mule deer (*Odocoileus hemionus*) are the primary big game species occurring throughout the study area. Most of the area is considered to be low-quality habitat except for certain areas along the Virgin River. Coyote (*Canis latrans*), bobcat (*Lynx rufus*), raccoon (*Procyon lotor*), kit fox (*Vulpes macrotis*), badger (*Taxidea taxus*), and ringtail cat (*Bassariscus astutus*) occur in limited numbers in the study area (Douglas 1999).

3.12.3.3 Small Mammals

Several small mammals were observed throughout the study area. These include blacktail jackrabbit (*Lepus californicus*), desert cottontail (*Sylvilagus audubonii*), least chipmunk (*Eutamias minimus*), white-tailed antelope ground squirrel (*Ammospermophilus leucurus*), Botta's pocket gopher (*Thomomys bottae*), and desert wood rat (*Neotoma lepida*).

Several heteromyid and cricetid rodents were found near the study area. These species are listed as Utah species of special concern because of declining populations and/or limited distribution (UDWR 1998). Sampling was conducted in July 1999. The following species were captured and released at five sample sites in the study area: chisel-toothed kangaroo rat (*Dipodomys microps celsus*), Merriam's kangaroo rat (*Dipodomys merriami*), desert kangaroo rat (*Dipodomys deserti*), cactus mouse (*Peromyscus eremicus*), and southern grasshopper mouse (*Onychomys torridus*) (Kass 1999).

Numerous bats are known to roost or forage in the study area. These include Yuma myotis (*Myotis yumanensis*), western small-footed myotis (*Myotis lleibii*), big brown bat (*Eptesicus fuscus*), pallid bat (*Antrozous pallidus*), western pipistrelle (*Pipistrellus hesperus*), and silver-haired bat (*Lasionycteris noctivagans*) (Greystone 1997a).

3.12.3.4 Reptiles and Amphibians

Reptiles and amphibians observed in the study area include collared lizard (*Crotaphytus collaris*), leopard lizard (*Gambelia wislizenii*), short-horned lizard (*Phrynosoma douglasii*), northern side-blotched lizard (*Uta stansburiana*), sagebrush lizard (*Sceloporus gracilis*), western whiptail lizard (*Cnemidophorus tigris*), desert spiny lizard (*Sclerophorus magister*), and Great Basin spadefoot (*Scaphiopus intermontanus*). These species were commonly sighted throughout the study area in all habitats.

3.12.3.5 Birds

Cliff-nesting raptors observed in the study area include golden eagle (*Aquila chrysaetos*), red-tailed hawk (*Buteo jamaicensis*), American kestrel (*Falco sparverius*), prairie falcon (*Falco mexicanus*), and great horned owl (*Bubo virginianus*). Common raven (*Corvus corax*) is abundant in the area and was included in the survey results due to their behavioral and nesting similarities to raptors. Fifteen active and fourteen inactive raptor nests were identified within or very close to the study area. A total of 47 bird species were observed in the study area (see Appendix B, Bird Species).

3.13 Floodplains

Floodplains are defined as areas inundated by storm water runoff. Encroachment into these areas can reduce the flood-carrying capacity of the floodplain and extend the flooding hazard beyond the encroachment area. In response to escalating taxpayer costs for flood disaster relief, Congress established the National Flood Insurance Program. This program is a voluntary mitigation program administered by the Federal Emergency Management Agency (FEMA). The program is based on an agreement whereby the federal government makes flood insurance available in those communities that practice sound floodplain management. This incentive encourages state and local governments to develop and implement floodplain management programs.

3.13.1 FEMA Studies and Maps

Flood Hazard Areas. In the 1980s, FEMA performed hydrologic and hydraulic studies to identify and map special flood hazard areas within communities. A special flood hazard area is defined as an area with a 1% chance of being flooded in any given year, also known as a 100-year storm event. The 100-year river or stream flood is the flow rate and water surface elevation during a 100-year storm

event. A result of the FEMA studies is the development of flood insurance rate maps that depict the floodplains for each river and creek analyzed.

In this context, a floodplain consists of both the floodway and the floodway fringe. The floodway is the defined stream channel and the adjacent areas that must be kept free of encroachment to pass the 100-year flood without substantially increasing the upstream water surface elevation. The floodway fringe is the area between the floodway and the boundary of the floodplain. Zone A is defined as the flood insurance rate zone that corresponds to the 100-year floodplain.

3.13.2 Floodplains in the Study Area

The proposed Southern Corridor project encroaches on three major drainage areas: the Atkinville Wash, the Fort Pearce Wash, and the Virgin River, shown in Figure 3-12, Water Resources. There are several small dry washes in the proposed study area that convey storm water runoff; however, these washes have no defined floodplain regulatory boundaries.

The following information was taken from the available flood insurance rate maps produced by FEMA. Maps for the Virgin River west of Hurricane have not been printed (Watanabea 2001). WCWCD is currently conducting a study on the Virgin River floodplain in the unincorporated part of the county between the Hurricane and Washington City boundaries.

Atkinville Wash. The Atkinville Wash is located in the southern part of the study area near I-15. A large part of its drainage area is in Arizona. FEMA has mapped the Atkinville Wash within the St. George municipal boundary as flood hazard Zone A. Nuisance water (such as lawn water and street runoff) has been flowing into the wash from residential development, allowing invasive species to grow. This vegetation is increasing the floodplain by contributing to silt buildup.

Fort Pearce Wash. The Fort Pearce Wash is the main collector channel for the southern part of the study area. The Fort Pearce Wash is about 250 feet wide near where it crosses the study area. The channel has several meanders, but where it crosses the study area, flows are north to northwest. The Fort Pearce Wash drains an area of over 1,000,000 acres; therefore, large flood flows can be expected during periods of heavy rain (USGS 1997). FEMA has mapped the Fort Pearce Wash within the St. George municipal boundary, located west of the crossing, as flood hazard Zone A.

Virgin River. The Virgin River is the main watercourse near the study area. The Southern Corridor nears the Virgin River floodplain where the study area, after running northeast along the base of Warner Ridge, turns east at a location south

of the Virgin River. The Virgin River has what appears to be a flood “shelf” above the ordinary high-water mark, having established woody vegetation and some wetlands. Due to the lack of floodplain maps for this area, it is assumed that the shelf is part of the floodplain.

3.14 Threatened and Endangered Species

Special status species include plant and animal species that are currently listed, or are proposed for listing, as threatened and endangered by the U.S. Fish and Wildlife Service. Special status species also include State of Utah sensitive species (UDWR 1998). All species listed by the above agencies as occurring or potentially occurring in the study area are presented in following sections (see Table 3.14-1). The study area for threatened and endangered species is the southern part of Washington County adjacent to the Southern Corridor alternatives that could be affected by construction and operation of the highway. This area includes the greater habitat range for any listed species.

Table 3.14-1. Status and Probability of Occurrence of Special Status Species in the Southern Corridor

Common Name	Scientific Name	Sensitive Status		Probability of Occurrence
		Fed.	State	
Plants				
Bearclaw poppy	<i>Arctomecon humilis</i>	E	—	Known to occur*
Holmgren milkvetch	<i>Astragalus holmgreniorum</i>	E	—	Known to occur*
Shivwits milkvetch	<i>Astragalus ampullariodes</i>	E	—	Known to occur outside study area
Siler cactus	<i>Pediocactus sileri</i>	E	—	Known to occur
Birds				
Southwestern willow flycatcher	<i>Empidonax traillii extimus</i>	E	E	Known to occur outside study area
Burrowing owl	<i>Athene cunicularia</i>	—	SP	Historic occurrence in the study area
Bald eagle	<i>Haliaeetus leucocephalus</i>	T	T	Known to occur
Yellow-billed cuckoo	<i>Coccyzus americanus occidentalis</i>	C	T	Low
Peregrine falcon	<i>Falco peregrinus anatum</i>	—	E	Known to occur outside study area
Ferruginous hawk	<i>Buteo regalis</i>	—	T	Low

Common Name	Scientific Name	Sensitive Status		Probability of Occurrence
		Fed.	State	
Swainson's hawk	<i>Buteo swainsoni</i>	—	SP	Low
Bell's vireo	<i>Vireo bellii</i>	—	SP/SD	Low
Blue grosbeak	<i>Guiraca caerulea</i>	—	SP	Low
Common yellowthroat	<i>Geothlypis trichas</i>	—	SP	Low
Crissal thrasher	<i>Toxostoma crissale</i>	—	SP/SD	Low
Reptiles/Amphibians/Fish				
Desert tortoise	<i>Gopherus agassizii</i>	T	E	Historic occurrence in the study area
Gila monster	<i>Heloderma suspectum</i>	—	E	High
Virgin River chub	<i>Gila seminuda</i>	E	E	Known to occur in Virgin River
Woundfin	<i>Plagopterus argentissimus</i>	E	E	Known to occur in Virgin River
Virgin spinedace	<i>Lepidomeda mollispinis mollispinis</i>	—	CS	Known to occur in Virgin River
Speckled dace	<i>Rhinichthys osculus</i>	—	SP	Known to occur in Virgin River
Desert sucker	<i>Catostomus clarki</i>	—	SP	Known to occur in Virgin River
Flannelmouth sucker	<i>Catostomus latipinnis</i>	—	SP	Known to occur in Virgin River
Western chuckwalla	<i>Sauromalus obesus</i>	—	SP/SD	High
Southwestern toad	<i>Bufo microscaphus</i>	—	SP	Known to occur*
Utah banded gecko	<i>Coleonyx variegatus</i>	—	SD	High
Desert iguana	<i>Dipsosaurus dorsalis</i>	—	SD	Low
Mojave zebra-tailed lizard	<i>Callisaurus draconoides rhodictictus</i>	—	SD	Known to occur*
California king snake	<i>Lampropeltis getulus californiae</i>	—	SD	Low
Southwestern black-headed snake	<i>Tantilla hobartsmithi</i>	—	SD	Low
Sonoran lyre snake	<i>Trimorphodon biscutatus lambda</i>	—	SD	Low
Desert glossy snake	<i>Arizona elegans eburnata</i>	—	SD	Low

Common Name	Scientific Name	Sensitive Status		Probability of Occurrence
		Fed.	State	
Mojave desert sidewinder	<i>Crotalus cerastes cerastes</i>	—	SD	Low
Mojave patchnose snake	<i>Salvadora hexalepis mojavenensis</i>	—	SD	Low
Desert night lizard	<i>Xantusia vigilis vigilis</i>	—	SD	Low
Utah blind snake	<i>Leptotyphlops humilis utahensis</i>	—	SD	Low
Desert iguana	<i>dipsaurus dorsalis</i>	—	SD	Moderate
Mammals				
Big free-tailed bat	<i>Nyctinomops macrotis</i>	—	SP/SD	Low
Brazilian free-tailed bat	<i>Tadarida brasiliensis mexicana</i>	—	SP/SD	Low
Townsend's big-eared bat	<i>Plecotus townsendii</i>	—	SP/SD	Low
Western red bat	<i>Lasiurus blossevillei</i>	—	SP/SD	Low
Allen's big-eared bat	<i>Idionycteris phyllotis</i>	—	SD	Low
Fringed myotis	<i>Myotis thysanodes</i>	—	SD	Low
Spotted bat	<i>Euderma maculatum</i>	—	SP	Low
Ringtail	<i>Bassariscus astutus</i>	—	SD	Known to occur*
Desert kangaroo rat	<i>Dipodomys desertii</i>	—	SP/SD	Known to occur
Southern grasshopper mouse	<i>Onychomys torridus</i>	—	SD	Known to occur*
Cactus mouse	<i>Peromyscus eremicus</i>	—	SD	Known to occur*
T = Federal threatened, E = Federal endangered, C = Federal candidate, SP = State declining populations, SD = State limited distribution, CS = Conservation species, SP/SD = State declining population and limited range				
* Located on corridor during 1999–2000 inventory				

Two surveys for threatened and endangered species were conducted for the Southern Corridor project. A detailed survey of the entire Southern Corridor project area was conducted in 1999, followed by a second survey that looked only at modifications that were made to the corridor.

3.14.1 Definitions

3.14.1.1 Federal Status

Endangered (E). Species that are in danger of extinction throughout all or a significant part of their range.

Threatened (T). Species that are likely to become endangered in the foreseeable future throughout all or a significant part of their range.

Candidate (C). Species that are likely to be listed as threatened or endangered in the foreseeable future.

3.14.1.2 State Status

Endangered (E). Species that are threatened with extirpation or extinction from Utah resulting from very low or declining numbers, alteration or reduction of habitat, detrimental environmental changes, or any combination of the above.

Threatened (T). Species that are likely to become endangered in the foreseeable future throughout all or a significant part of their range in Utah or the world.

Species of Special Concern (SP/SD). Species that have experienced a substantial decrease in population, distribution, and/or habitat availability (SP), or occur in limited areas and/or numbers due to a restricted or specialized habitat (SD), or have both a declining population and limited range (SP/SD).

3.14.2 Federally Listed Species

3.14.2.1 Plants

Bearclaw Poppy (*Arctomecon humilis*), native to Washington County, is listed as endangered. It occurs primarily on the Shnabkaib Member of the Moenkopi Formation and is sometimes found on the Upper Red and Lower Red Members of the Moenkopi Formation. It is often associated with shadscale, indigo bush (*Psoralea fremontii*), Mormon tea, and cliffrose (*Cowania mexicana*). It is found at elevations from 2,460 to 3,510 feet, and it flowers April through May (Nelson and Harper 1991). Bearclaw poppy was located in the study area near Punchbowl Dome. About 15 to 20 plants were found on several isolated outcrops of the Shnabkaib Member of the Moenkopi Formation, and habitat was located at White Dome. Other areas of potential habitat were searched intensively for individual plants, but none were found.

Holmgren Milkvetch (*Astragalus holmgreniorum*) is listed as endangered and is located on the Virgin Limestone Member of the Moenkopi Formation. Plants are often found below yellowish-brown marine limestone ledges on red, fine-

textured soils in small washes. It grows with a mixture of warm and cold desert shrubs. It is found at elevations from 2,690 to 2,780 feet, and it flowers late March through April. Holmgren milkvetch was found at three locations in the Atkinville Wash area, and about 50 plants were counted at all three locations.

Siler Cactus (*Pediocactus sileri*) is listed as endangered and is found on the Shnabkaib Member of the Moenkopi Formation. Some plants may be found on the Middle Red Member of the Moenkopi Formation, which lies immediately below the Shnabkaib Member (Gierisch 1989). This species is found on all aspects at elevations between 2,800 and 5,400 feet and on slopes that range from 0 to 80 degrees. Siler cactus is found in the warm desert in the salt desert shrub and pinyon-juniper zone. Siler cactus was not located in the study area, but it occurs just outside the study area at Warner Ridge and White Dome.

Shivwits Milkvetch (*Astragalus ampullaroides*) is listed as endangered and grows on gypsiferous soils on the Chinle Formation. It is commonly associated with scattered juniper and warm desert shrub communities. It is found at elevations from 3,440 to 3,770 feet, and it flowers April through May. Shivwits milkvetch was not located in the study area.

3.14.2.2 Birds

Southwestern Willow Flycatcher (*Empidonax traillii extimus*) is listed as endangered. Habitat for the southwestern willow flycatcher exists along the Virgin River at the north end of Warner Valley (Day 1999). Bird inventories indicated no potential habitat in the Atkinville or Fort Pearce Washes or in other sites in the study area. This species is also state endangered.

Bald Eagle (*Haliaeetus leucocephalus*) populations use the area in Washington County from November to April. Important bald eagle habitat includes Leeds Creek, Quail Creek, Quail Creek Reservoir, the Santa Clara and Virgin Rivers, and the Hurricane City sewer lagoons. BLM indicated winter roost sites at the junction of SR 9 and 4300 West near the sewer lagoons. The bald eagles use the site because of the ducks available as food on the sewer lagoons.

Yellow-Billed Cuckoo (*Coccyzus americanus occidentalis*) is a federal candidate species and a state threatened species. It is a tropical migrant and nests in localized riparian habitats throughout Utah and the West. It was not located in the study area and has a low potential for occurrence.

3.14.2.3 Reptiles

Desert Tortoise (*Gopherus agassizii*) is a federally threatened and state endangered species and is found in the Red Cliffs Desert Reserve as part of the Washington County Habitat Conservation Plan. It occupies desert washes, dunes,

and rocky slopes in creosote and Joshua tree communities. The study area could theoretically support desert tortoises, but no data indicate recent occupation.

3.14.2.4 Fish

Woundfin (*Plagopterus argentissimus*) is listed as endangered and occurs in the Virgin River above Lake Mead in Nevada, upstream of the confluence of Ash and La Verkin Creeks.

Virgin River Chub (*Gila seminuda*) is listed as endangered and occurs in an approximately 50-mile stretch of the Virgin River between Mesquite, Nevada, and the La Verkin Creek confluence near Hurricane.

3.14.3 State Sensitive Species

3.14.3.1 Birds

Peregrine Falcon (*Falco peregrinus anatum*) is a state endangered species and is found outside the study area in Zion National Park. The peregrine was not located in the study area.

Ferruginous Hawk (*Buteo regalis*) is a state threatened species and is found at high elevations outside the study area in pinyon-juniper woodland/grassland transition zones. This species was not located in the study area.

Swainson's Hawk (*Buteo swainsoni*) is a state species of special concern (SP) and is a neotropical migrant that nests in open desert grasslands. This species was observed outside the study area as a fall migrant.

Burrowing Owl (*Athene cunicularia*), a state species of special concern (SP), is a neotropical migrant and nests in desert valleys and grasslands. An abandoned nest was found in the study area near Punchbowl Dome. Several historic sites have been discovered since the 1999 inventory near Leucadia and Sand Hollow (Beckstrom 2001).

Bell's Vireo (*Vireo bellii*) is a state species of special concern (SP/SD) and is a neotropical migrant that nests in willows on the Virgin River. This species was not located in the study area.

Blue Grosbeak (*Guiraca caerulea*) is a state species of special concern (SP) and is a neotropical migrant that has been located along the Virgin River (UDWR 1998). This species was not located in the study area.

Common Yellowthroat (*Geothlypis trichas*) is a state species of special concern (SP) and is a neotropical migrant and nests along the Virgin River (UDWR 1998). This species was not located in the study area.

Crissal Thrasher (*Toxostoma crissale*) is a state species of special concern (SP/SD) and nests in dense mesquite along the Virgin River. This species was not located in the study area and has a low potential for occurrence.

3.14.3.2 Reptiles

Gila Monster (*Heloderma suspectum*) is a state endangered species. Neither gila monsters nor signs (burrows or tracks) were observed in the study area. Beck (1985) cites Sand Mountain/Warner Valley as potential habitat for gilias. The 1999 inventory included a search of several areas, including the sandy areas bordering cliffs of Moenkopi sandstone between Washington Dome and Warner Ridge, but no gilias were found. Beck (1985) indicates that no gilias or tracks were seen in Warner Valley during his 1984 field inventory. Warner Valley and adjacent areas have been sufficiently altered by human activities to significantly decrease the area's reptile population (Barnum 1975).

Western Chuckwalla (*Sauromalus obesus*) is a state species of special concern (SP/SD). Chuckwallas inhabit rock outcrops that are vegetated with shrubs and forbs. There is considerable potential for chuckwalla habitat in the study area, especially in the Warner Ridge area. Mader (1998) indicated the presence of chuckwallas in the Atkinville and Fort Pearce Wash areas, but the 1999 inventory did not locate any in the study area.

Southwestern Toad (*Bufo microscaphus*) is a state species of special concern (SP) and is found in moist, shaded canyons associated with Willow Springs. Willow Springs is a small desert riparian zone that occurs in the shaded canyons of the Upper Red Member of the Moenkopi Formation.

Utah Banded Gecko (*Coleonyx variegatus*) is a state species of special concern (SD). This species occurs in very dry habitats with rocky terrain, canyon walls, and sand dunes. This species was not located in the study area and its potential occurrence is high.

Desert Iguana (*Dipsosaurus dorsalis*) is a state species of special concern (SD). This species occurs in sandy and rocky areas in creosote bush, but was not located in the study area and its potential occurrence is low.

Mojave Zebra-Tailed Lizard (*Callisaurus draconoides rhodictus*) is a state species of special concern (SD) and was found in five locations including Washington Dome, Warner Ridge, and Atkinville Wash. Habitats varied from sandy washes to caliche and gypsum substrates. Vegetation consisted of blackbrush, creosote bush, range ratany, mesa dropseed (*Sporobolus flexuosus*), and sandsage (*Artemisia filifolia*).

California King Snake (*Lampropeltis getulus californiae*) is a state species of special concern (SD) and inhabits rocky wooded slopes and riparian areas. This species was not located in the study area and its potential occurrence is low.

Southwestern Black-Headed Snake (*Tantilla hobartsmithi*) is a state species of special concern (SD) and inhabits wooded canyons, arroyos, and riparian areas. This species was not located in the study area and its potential occurrence is low.

Sonoran Lyre Snake (*Trimorphodon biscutatus lambda*) is a state species of special concern (SD) and is found in rocky areas in grassland and creosote. This species was not located in the study area and its potential occurrence is low.

Desert Glossy Snake (*Arizona elegans eburnata*) is a state species of special concern (SD) and is found in creosote-mesquite habitats. This species was not located in the study area and its potential occurrence is low.

Mojave Desert Sidewinder (*Crotalus cerastes*) is a state species of special concern (SD) and inhabits sandy areas. This species was not located in the study area and its potential occurrence is low.

Mojave Patch-Nose Snake (*Salvadora hexalepis mojavnensis*) is a state species of special concern (SD) and inhabits desert scrub. This species was not located in the study area and its potential occurrence is low.

Desert Night Lizard (*Xantusia vigilis vigilis*) is a state species of special concern (SD) and inhabits rock outcrops among fallen leaves and trunks of yuccas and agaves. This species was not located in the study area and its potential occurrence is low.

Utah Blind Snake (*Leptotyphlops humilis utahensis*) is a state species of special concern (SD) and inhabits a variety of habitats suitable for burrowing. This species was not located in the study area and its potential occurrence is low.

3.14.3.3 Fish

Virgin Spinedace (*Lepidomeda mollispinis mollispinis*) is a state conservation species restricted to the Virgin River Basin and was not located in the study area.

Speckled Dace (*Rhinichthys osculus*) is a state species of special concern (SP) and occurs in desert springs throughout Utah and the lower Colorado River. This species was not located in the study area.

Desert Sucker (*Catostomus clarki*) is a state species of special concern (SP) and is restricted to the Virgin River Basin. This species was not located in the study area.

Flannelmouth Sucker (*Catostomus latipinnis*) is a state species of special concern (SP) and is native to the Colorado River Basin. This species was not located in the study area.

3.14.3.4 Mammals

Big Free-Tailed Bat (*Nyctinomops macrotis*) is a state species of special concern (SP/SD) whose range extends throughout the southern two-thirds of Utah. This species is very rare and was not located in the study area. Its potential occurrence is low.

Brazilian Free-Tailed Bat (*Tadarida brasiliensis mexicana*) is a state species of special concern (SP/SD) and can be found in southern Utah. This species is migratory and was not located in the study area. Its potential occurrence is low.

Townsend's Big-Eared Bat (*Plecotus townsendii*) is a state species of special concern (SP/SD). This species has a statewide distribution but was not located in the study area. Its potential occurrence is low.

Western Red Bat (*Lasiurus blossevillei*) is a state species of special concern (SP/SD). This species has been confirmed in Washington County but was not located in the study area. Its potential occurrence is low.

Allen's Big-Eared Bat (*Idionycteris phyllotis*) is a state species of special concern (SD). This species is not well-known and could possibly occur in the study area.

Fringed Myotis (*Myotis thysanodes*) is a state species of special concern (SD). This species has a statewide distribution but was not located in the study area. Its potential occurrence is low.

Spotted Bat (*Euderma maculatum*) is a state species of special concern (SP). This species is declining throughout the West and was not located in the study area. Its potential occurrence is low.

Ringtail (*Bassariscus astutus*) is a state species of special concern (SD). This species was located along the Virgin River just outside the study area and is expected to occur throughout the study area.

Desert Kangaroo Rat (*Dipodomys desertii*) is a state species of special concern (SP/SD) and is restricted to Washington County. It was not located in the study area and its potential occurrence is moderate.

Southern Grasshopper Mouse (*Onychomys torridus*) is a state species of special concern (SD) and was found throughout the study area in desert scrub vegetation.

Cactus Mouse (*Peromyscus eremicus*) is a state species of special concern (SD) and was found at three locations in the study area in mesic shaded canyons.

3.15 Historic, Archaeological, and Paleontological Resources

Cultural resources include prehistoric and historic sites, structures, districts, buildings, objects, or any other physical evidence of human activity considered important to a culture, subculture, or community for scientific, traditional, religious, or any other reasons. For ease of discussion, cultural resources have been divided into historic and prehistoric sites, native populations/traditional resources, and paleontological resources. The study area or area of potential effect for this project includes all potential right-of-way for the proposed alternatives.

Both cultural and paleontological literature and field surveys were completed by qualified specialists in these disciplines. A detailed description of the survey methodology can be found in *Cultural Resources and Fossil Inventory of Utah Department of Transportation's Southern Corridor Project, Washington County, Utah* (Montgomery Archaeological Consultants 2002).

3.15.1 Methodology

3.15.1.1 Regulatory Guidelines

The cultural, historic, and paleontological resources inventory was completed to comply with federal and state guidelines, including:

- Federal Antiquities Act of 1906 (Public Law [PL] 59-202, 32 Stat. 225)
- Mining Law of 1872 (amended 1962)
- National Historic Preservation Act of 1966 as amended (PL 89-665, 80 Stat. 915; 16 U.S.C. 470), including Sections 106 and 110
- Archaeological and Historic Data Preservation Act of 1974 (PL 86-253, as amended)
- Executive Order 11593, Protection and Enhancement of the Cultural Environment, 36 CFR 800
- Native American Graves Protection and Repatriation Act of 1992 (43 CFR 10)
- Archaeological Resource Protection Act of 1979 (16 U.S.C. 1997)
- U.S. Department of Transportation Act, Section 4(f)
- American Indian Religions Freedom Act (42 U.S.C. 1996)
- Utah Antiquities Protection Act of 1992 (UAC 9-8-404; UAC 63-73-19)

3.15.1.2 Literature and Field Surveys

Prior to field surveys, a literature review was conducted to determine the known cultural and paleontological remains that might be found in the study area. Literature searches were conducted at the BLM Field Office in St. George and at the Division of State History in Salt Lake City. Additionally, the Utah State Paleontology Office reviewed paleontological records.

An intensive cultural resource walking survey was performed for this project. An area of 4,176 acres, varying in width from 400 to 3,000 feet, was examined for cultural resources in a series of parallel sweeps spaced at 30-foot intervals. Cultural resources discovered were recorded as either an archaeological site or isolated find (Montgomery Archaeological Consultants 2002).

3.15.2 Resource Inventory

3.15.2.1 Historic and Prehistoric Sites

The resource inventory resulted in documentation of 107 newly recorded sites, 28 previously recorded sites, and 90 isolated finds or artifacts. These included 103 prehistoric sites, 18 historic sites, and 14 sites with prehistoric and historic components. Based on the temporally diagnostic artifacts found at these sites, the inventory area was inhabited by the Archaic, Virgin Anasazi, Southern Paiute, and European-American groups.

Seventy-five prehistoric sites, five historic sites, and five with dual components (prehistoric and historic) are evaluated as potentially eligible for inclusion in the National Register of Historic Places (NRHP). Appendix H, Cultural and Paleontological Resources, provides a list of all cultural resources identified in the Southern Corridor area of potential effect (Montgomery Archaeological Consultants 2002).

Of the potentially NRHP-eligible sites, 82 sites are potentially eligible under criterion D, 1 site under criteria C and D, and 2 sites under criteria A and C. Criterion A sites are potentially eligible for historic events that contribute to broad patterns of history; criterion C sites are potentially eligible as historically important representatives of a type, period, or method of construction; and criterion D sites are potentially eligible for information potential.

3.15.2.2 Native Populations/Traditional Resources

A consultation letter regarding the Southern Corridor was sent to various Native American groups including the Kaibab Paiute Tribal Council; Shivwits Band, Paiute Indian Tribe; Hopi Tribal Council; Moapa Paiute Tribe of Nevada; Paiute Indian Tribe of Utah Tribal Council; Cedar Band, Paiute Indian Tribe of Utah;

Las Vegas Tribal Council; and the Navajo Nation. Of these groups, the Hopi Tribe and Cedar Band of Paiutes responded, requesting to be in consultation regarding the cultural resources survey.

3.15.2.3 Section 106 Consulting Parties

As part of the Section 106 process, the following groups are involved in the consultation process: FHWA, UDOT, State Historic Preservation Office, federal Advisory Council on Historic Preservation, BLM, Utah Professional Archaeological Council, Utah Statewide Archaeological Society, Washington County Historical Society, and the Native American groups identified in Section 3.15.2.2, Native Populations/Traditional Resources.

3.15.2.4 Paleontological Resources

A letter requesting paleontological information was sent to the Utah Geological Survey. The Utah Geological Survey indicated that no paleontological resources have been documented in the study area. The Quaternary alluvial deposits and basalts have a low potential for yielding significant fossils. However, the Jurassic Navajo Sandstone and the Triassic Moenkopi and Chinle formations in the study area have the potential for vertebrate fossils, particularly vertebrate tracks and trackways.

A paleontological survey was completed for the study area. Thirteen sites were located, recorded, and rated (see Appendix H, Cultural and Paleontological Resources). Fossils found at these sites included invertebrates (gastropods), plants (petrified wood and impressions), and trace fossils (invertebrate burrows and possible vertebrate track casts).

A rating system was used to determine the sensitivity of the site. The sensitivity rating terms included critical, significant, important, insignificant, and unimportant, with critical being of highest sensitivity and unimportant the lowest sensitivity. Of the 13 sites, 1 was rated significant to critical, 3 were rated significant, 4 were rated important, 4 were rated insignificant, and 1 was rated unimportant (Montgomery Archaeological Consultants 2002).

3.16 Hazardous Waste Sites

This section discusses the occurrence of known and potential hazardous waste sites in and near the study area. Issues of potential concern associated with such sites are:

- The spread of existing soil or groundwater contamination through road construction activities
- Increased construction costs
- Short- and long-term liability associated with the acquisition of environmentally distressed properties
- Worker health and safety

The Division of Environmental Response and Remediation (DERR) maintains environmental databases on sites with known contamination and sites that are regulated according to the requirements of state or federal laws. The following is a list of environmental databases maintained by DERR:

- Superfund Sites, Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA)
- National Priorities List (NPL), priority CERCLA sites
- Underground Storage Tanks (UST), Resource Conservation and Recovery Act (RCRA)
- Leaking Underground Storage Tanks (LUST)
- Brownfield Projects
- Toxic Release Inventory (TRI)
- Voluntary Release Cleanup Program (VCP)

Review of DERR's interactive map viewer on September 27, 2001, which includes links to the databases listed above, showed no known hazardous waste sites in or immediately adjacent to the study area. UDEQ is not aware of any environmental investigations or known hazardous materials sites in the vicinity of the Southern Corridor (Thomas 2001).

Because of their land use designations, parts of the study area could have the potential to contain hazardous materials. The location of these sites was based on a review of aerial photographs and field surveys. No field investigations or sampling for hazardous waste were conducted. Suspect properties include areas near the Klein Property development where materials have been dumped in area

washes, a scrap yard at the east end of 1580 South near Washington Fields, and various farms near Willow Springs and on the Flora Tech Road sites that have the potential to contain soil or groundwater contamination (see Figure 3-15, Potential Hazardous Waste Sites).

3.17 Visual Resources

3.17.1 Methodology

Visual resource management (VRM) classifications are established through the resource management planning process for BLM-administered lands according to the BLM Manual Handbook 8410-1 (January 17, 1976). VRM objectives are defined by four class objectives:

- Class I designates the preservation of the sensitive character of the landscape.
- Class II or III objectives are to retain or partially retain the existing character of the landscape.
- Class IV allows for major modification to the character of the landscape.

Class II, III, and IV objectives were identified in the study area.

3.17.2 Visual Resources of Proposed Project as Seen from Offsite

The project sits at the juncture of three physiographic provinces: the Colorado Plateau, the Basin and Range, and the Mojave Desert. Among the cliffs, domes, and plateaus is a sandy desert valley and the riparian zone of the Virgin River. Intermittent layers of red clay soil and white gypsiferous soils add to the scenic nature of the cliffs and domes.

Parts of this project fall within the BLM St. George Field Office district. Many of the scenic views in the study area are considered by BLM to be part of a visually sensitive region. Along the corridor study area, the unique views include the Virgin River floodplain, Washington Dome, White Dome, and Warner Ridge with Punchbowl Dome.

3.17.3 Visual Resources from the Study Area

Ten areas or viewsheds adjacent to the proposed alternative were chosen to represent the visual quality of the corridor, as shown in Figure 3-16, Visual Resources Key Observation Points. The photographs taken at each key observation point (KOP) are shown in Appendix E, Key Observation Point Photographs, and are described below. Based on federal highway guidelines, the

viewsheds were described by the distance from the road, identification of the viewer, and each viewpoint's specific characteristics and elements.

3.17.3.1 White Dome (KOP 1)

White Dome is a white gypsiferous sedimentary outcrop in the southern part of the corridor. Since White Dome falls within State of Utah lands, there is no designated BLM VRM class. Its unique form and white color make White Dome stand out against the red soil and green vegetation of the valley surrounding it. However, heavy ATV use has altered the visual characteristic, causing erosion of White Dome and detracting from its visual appeal.

3.17.3.2 Long Vista View (KOP 2)

The Vista View is a section of the proposed alternative that runs north and south along Warner Ridge with a view from Washington Dome. The viewshed runs between the private land of the proposed Redhawk Subdivision and BLM land with VRM Classes III and IV. The northern view shows a red clay soil and vegetative foreground with Washington Dome and the dark Pine Valley Mountains of the Dixie National Forest in the background. The eastern view also shows the vegetation and red soil with Warner Ridge, a stratified sedimentary uplift form, in the background. The long view with the vegetation and red soils in the foreground and middle ground demonstrate high continuity with color, texture, and line. Warner Ridge, an east dip slope, fills the middle ground and background view with high dominance and continuity. Viewers of this viewshed are mainly recreationists.

3.17.3.3 Warner Ridge/Warner Valley—Virgin River Floodplain (KOP 3)

The third view is in the location of a proposed large cut-and-fill area at the edge of Warner Ridge and at the entrance to Warner Valley. This viewshed falls within private land, water conservancy district boundaries, and the BLM land which has a VRM class of II and IV. From this area, the Virgin River floodplain can be seen as a blue and green belt of water and vegetation. The defined view of this area can be seen by residents north of the floodplain, by recreationists in Warner Valley, and by travelers driving north or south on the proposed alternative. The edge of Warner Ridge has a weathered sedimentary outcrop sloping to the southeast. There is an existing cut of the outcrop from an existing unpaved road located through the ridge to avoid the Virgin River floodplain and Washington Canal to the north. On the east side of this outcrop is the beginning of Warner Valley, which connects Warner Ridge and the Sand Mountains. The desert valley floor, sandwiched between the two rock outcrops, is enriched by the

presence of the Virgin River and the Washington Canal. This influence produces a diversity of colors and texture with vegetation and water.

3.17.3.4 Outlaw Ridge—Dixie Springs (KOP 4)

The fourth view area is located in the viewshed of Winding River property, so there is no BLM VRM class for this area. Just north of SR 9 and Hurricane, this viewshed focuses on the most developed section of the study area. The diversity of the viewshed includes the native desert landscape combined with farmland, utility lines, roads, and residences. The foreground views show agricultural and fallow land, and one small group of houses with light vegetation adds to the continuity of the viewshed. The Dixie Springs proposed subdivision area is in the background to the south. The view to the west and northwest shows the edge of the Harrisburg Bench, a stratified sedimentary uplift, and Red Reef, a pink sedimentary deposit, in the middle ground. The background view is of the Pine Valley Mountains.

3.17.3.5 Sand Dunes (KOP 5)

This viewshed land is owned by BLM and WCWCD. The VRM classification for the BLM land is Class IV. This view is facing east. The proposed alternative is east of the rock outcrops and closer to the eastern ridge. It loops around the sand dunes and Sand Hollow Reservoir development. On the rock outcrops, there is evidence of perching birds. The dominant vegetation is sand sage (*Artemisia filifolia*), black brush (*Coleogyne tridentata*), and snakeweed (*Gutierrezia sarothrae*). The surface soil is arid, red, and sandy. Viewers of this viewshed are mainly recreationists.

3.17.3.6 Sand Hollow Reservoir (KOP 6)

The land is owned by SITLA and a private owner. There is no designated BLM VRM class for this area. The alternative follows the eastern ridge just above the sand dunes and overlooks the Sand Hollow Reservoir. The Beaver Dam Mountains are in the background. The dominant vegetation is sand sage (*Artemisia filifolia*) and black brush (*Coleogyne tridentata*). Along the eastern ridge rock there are outcrops and evidence of perching birds. The soil is arid, red, sandy, and rocky closer to the east ridge. Viewers of this viewshed are mainly recreationists.

3.17.3.7 Sullivan Knoll (KOP 7)

The land is owned by WCWCD and a private landowner. There is no designated BLM VRM class for this area. The alternative is just west of Sullivan Knoll, and

the Pine Valley Mountains are in the background. The dominant vegetation indicates the arid environment with sand sage (*Artemisia filifolia*), creosote (*Larred tridentata*), black brush (*Coleogyne tridentata*), and cactus (*Opuntia echinocarpa* or *acanthocarpa*). The soil is arid and brownish-red. The area has rocky parts and many of the rocks in the ground are black. Viewers of this viewshed are recreationists and landowners.

3.17.3.8 State Road 9 (KOP 8)

The land is owned by a private owner, so there is no designated BLM VRM class for this area. This view is facing north looking at where the 2800 West Alternative would connect to SR 9. The Pine Valley Mountains are in the background. The dominant vegetation is sand sage (*Artemisia filifolia*), creosote (*Larred tridentata*), and black brush (*Coleogyne tridentata*). The soil is arid and brownish-red and appears more rocky than sandy. Viewers of the viewshed are motorists traveling on SR 9 and local landowners.

3.17.3.9 Vista View (KOP 9)

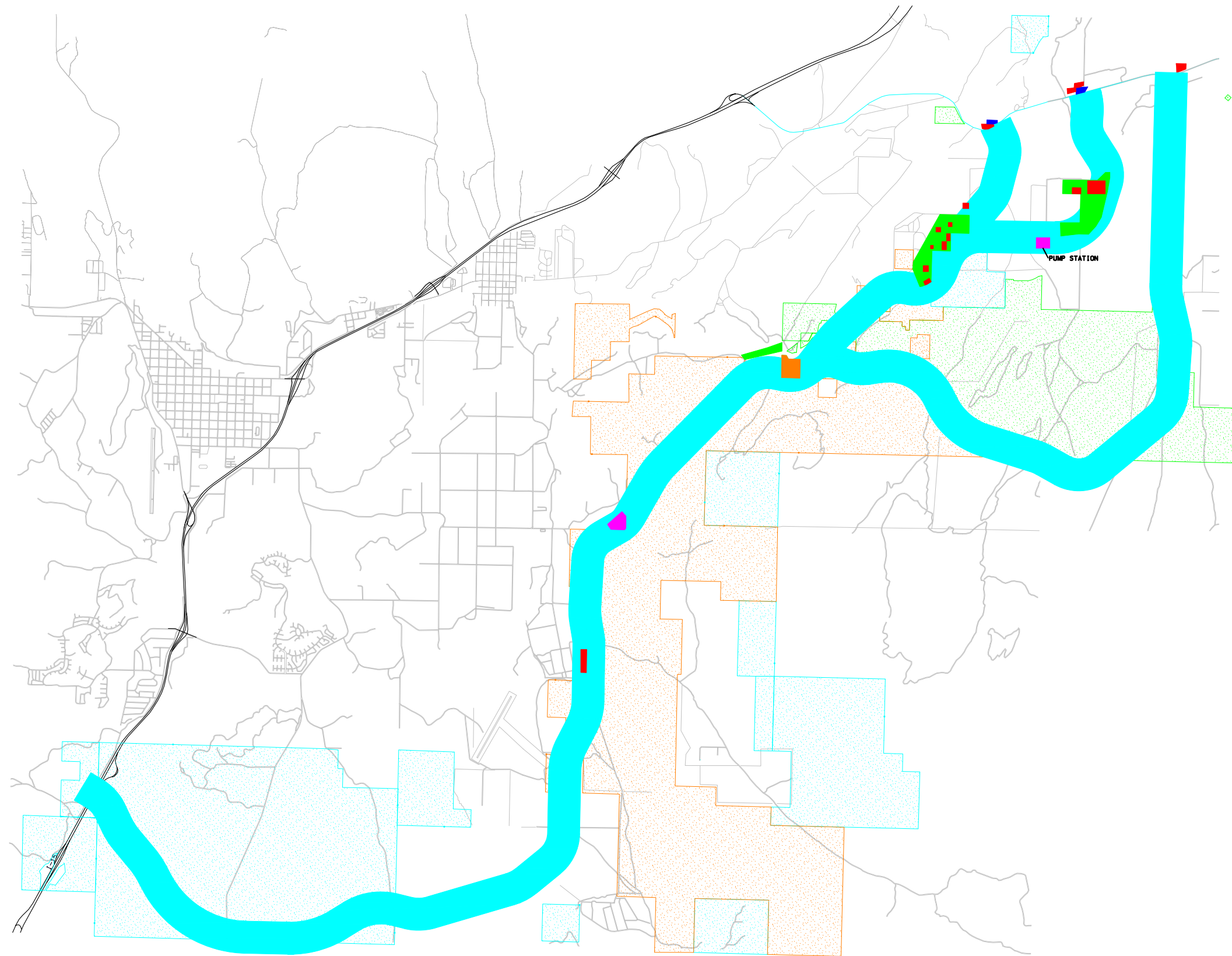
A small part of this area is owned by the State of Utah. The majority of this land is owned by a private landowner, so there is no designated BLM VRM class for this area. The view is facing northwest toward SR 9. The Red Mountains are in the background. The dominant vegetation is sand sage (*Artemisia filifolia*), creosote (*Larred tridentata*), black brush (*Coleogyne tridentata*), and Mormon tea (*Ephedra viridis*). The soil is arid and brownish-red. Viewers of the viewshed are the few homeowners who live nearby.

3.17.3.10 State Road 9 (KOP 10)

This area is owned by Outlaw Ridge development, so there is no designated BLM VRM class for this area. The view is facing south, away from the SR 9 connection. The wastewater lagoons are located to the west. The soil is arid and brownish-red. Viewers of the viewshed are motorists traveling on SR 9 and local homeowners.

3.18 Wild and Scenic Rivers

There are no wild and scenic rivers in the study area.



LEGEND

■ Open	■ State
■ Residential	■ BLM
■ Commercial	■ WCWCD (Water District)
■ Industrial	
■ Recreation	
■ Agricultural	

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FEET

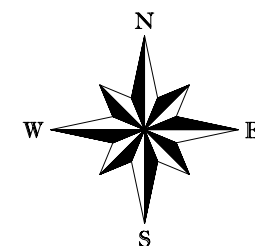
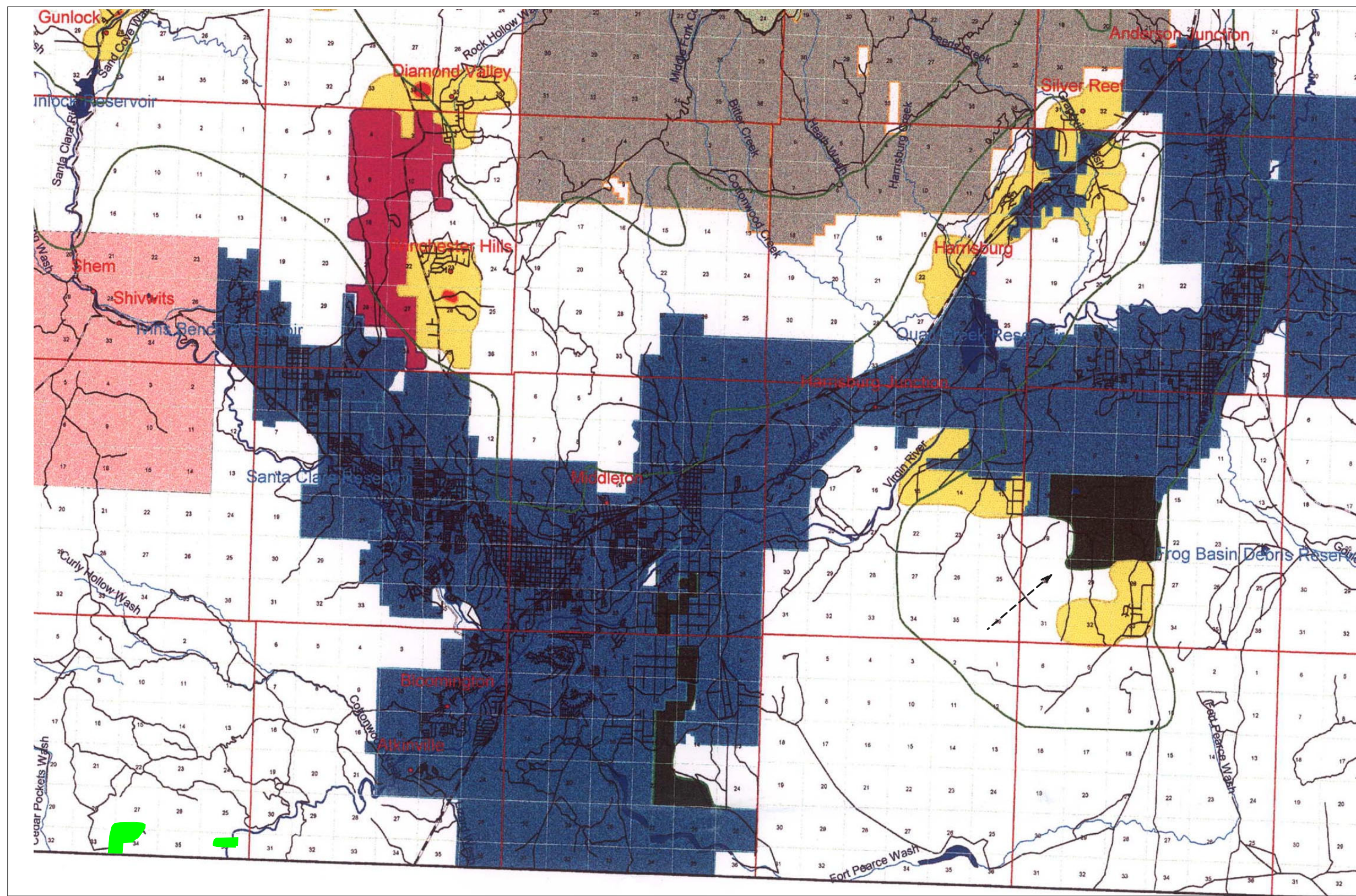










Figure 3-1 EXISTING LAND USE AND OWNERSHIP WITHIN 1 MILE OF THE ALTERNATIVES

Southern Corridor EIS
March 2003



LEGEND

	Shivwits Reservation		Dixie National Forest
	Snow Canyon State Park		Residential Areas
	Incorporated Areas		Agricultural Areas
	Pine Valley Wilderness Area		Beaver Mountain Wilderness Area

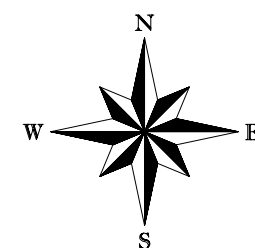
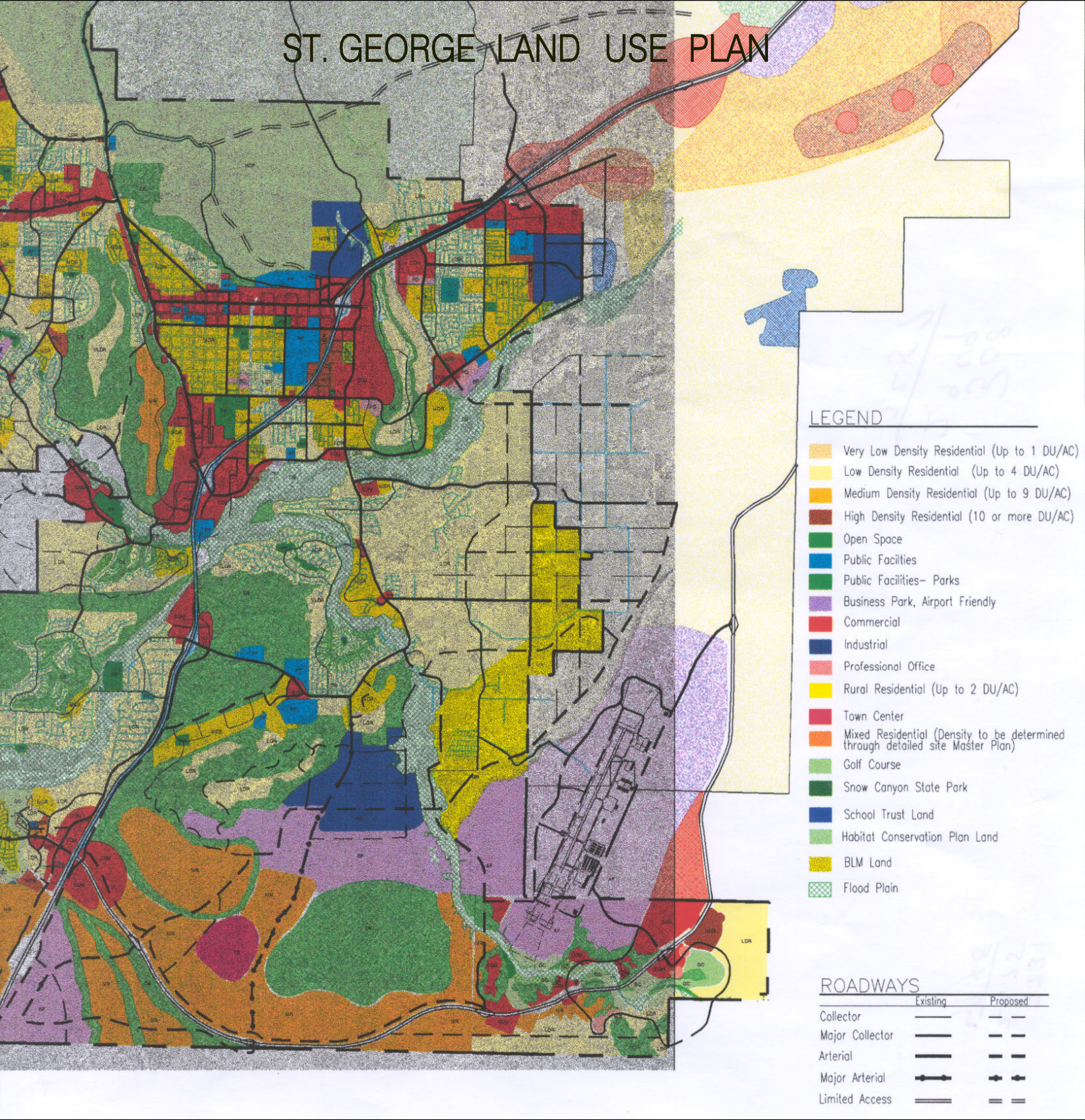


Figure 3-2

WASHINGTON COUNTY LAND USE

Southern Corridor EIS
September 2002



LEGEND

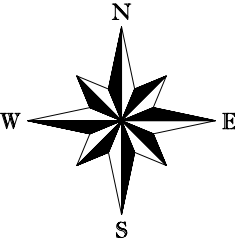


Figure 3-3

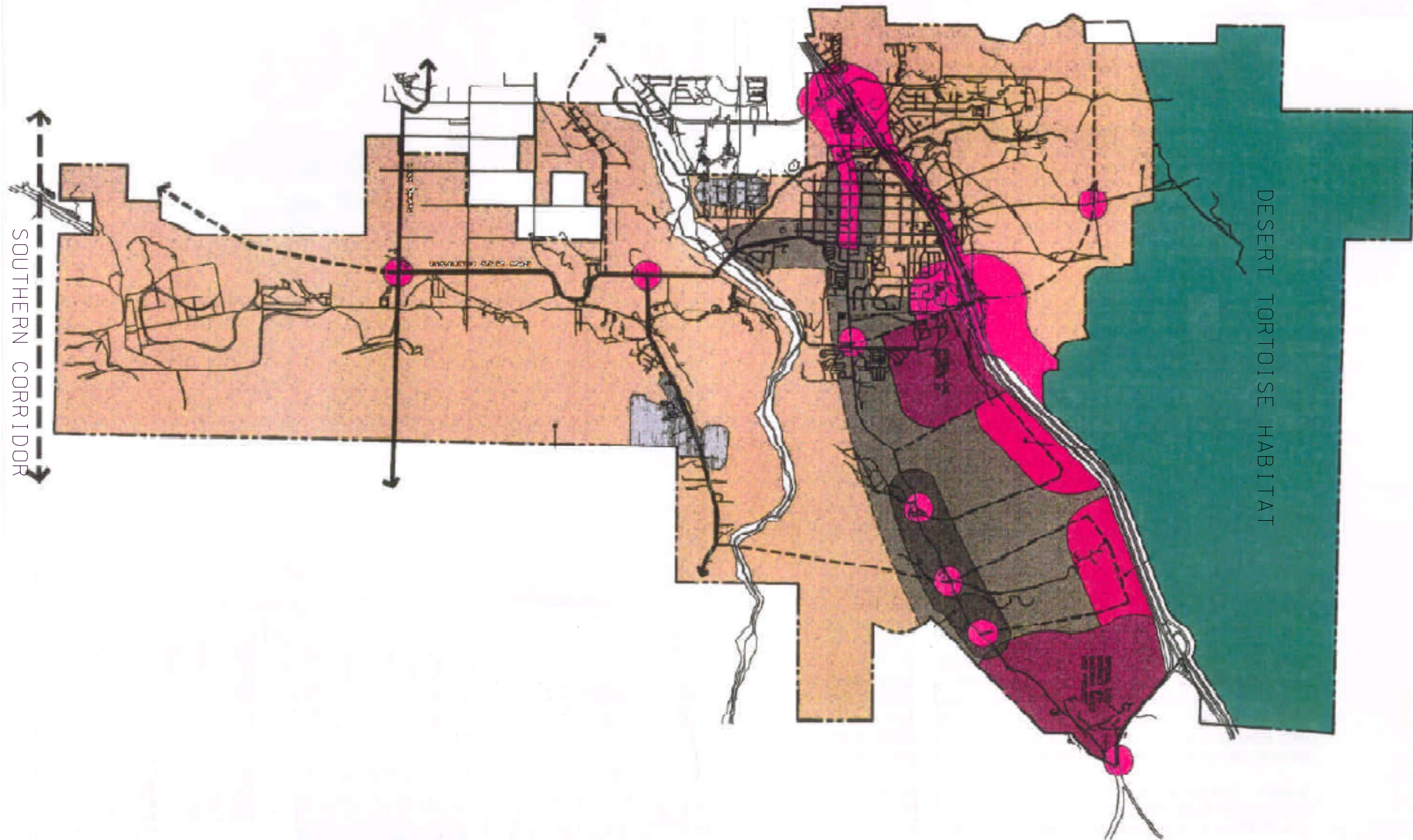
ST. GEORGE LAND USE

Southern Corridor EIS
March 2003

WASHINGTON CITY MASTER LAND USE PLAN

SOUTHERN CORRIDOR

DESERT TORTOISE HABITAT



LEGEND

- Special Use District
- Industrial
- Industrial/Business Park
- Commercial

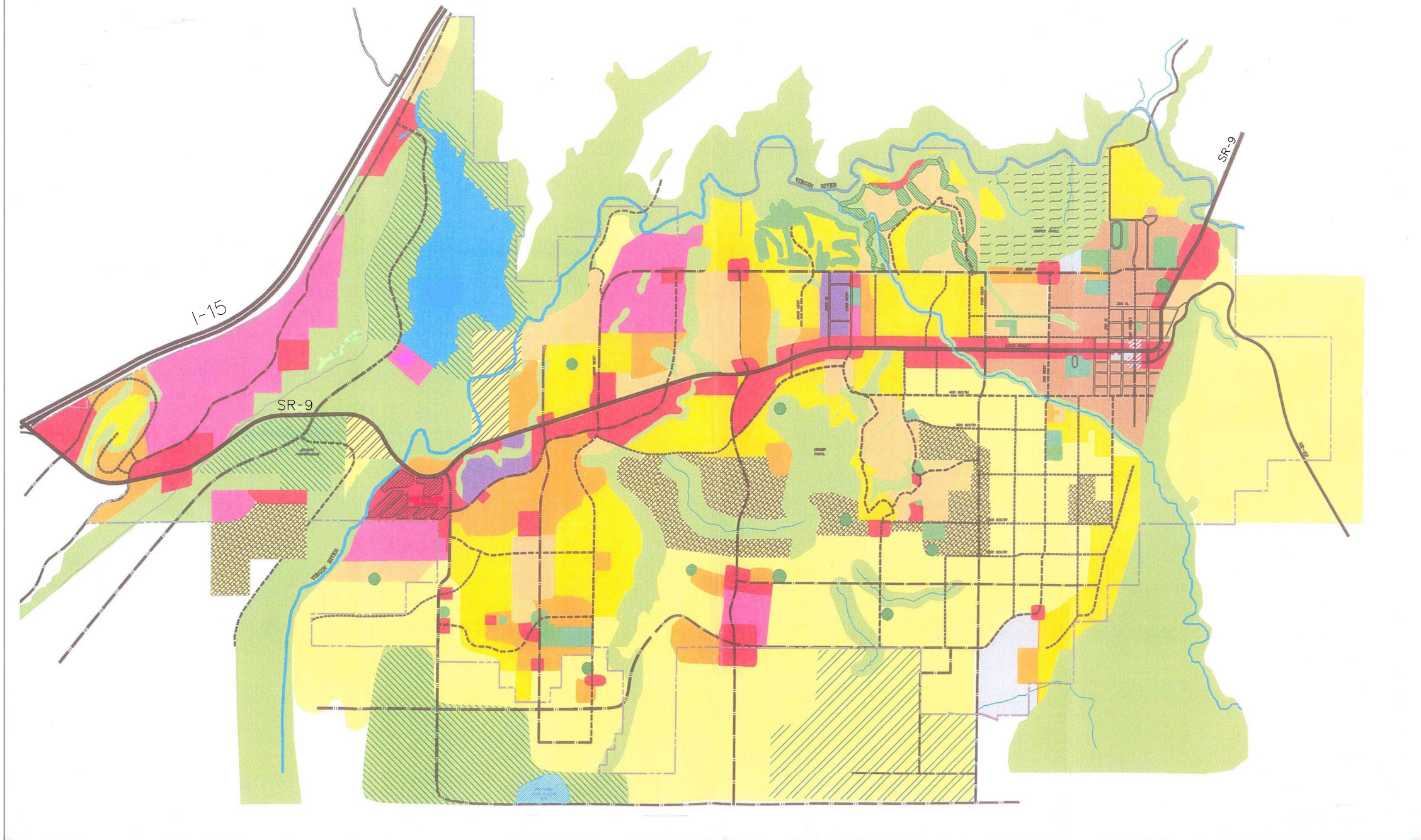
- High Density Residential (10-22 DU/Acre)
- Medium Density Residential (6-9 DU/Acre)
- Low Density Residential (1-5 DU/Acre)
- Open Space

Figure 3-4

WASHINGTON CITY MASTER LAND USE PLAN

Southern Corridor EIS
March 2003

HURRICANE CITY FUTURE LAND USE MAP



LEGEND

- Traditional Neighborhood
- Very Low Density Single Family Residential/Agricultural Mixed Use (One Unit per 5 Acres)
- Very Low Density Single Family Residential/Agricultural Mixed Use (One Unit per 2.5 Acres)
- Very Low Density Single Family Residential/Agricultural Mixed Use (One Unit per Acre)
- Low Density Single Family Residential/Agricultural Mixed Use (1-2 Units per Acre)
- Medium Density Single Family Residential (2-3 Units per Acre)
- High Density Single Family Residential (3-6 Units per Acre)
- High Density Multi-Family Residential (Townhouses, Apartments, 10-12 Units per Acre)
- Medium Density Multi-Family Residential (Townhouses, Apartments, 6-10 Units per Acre)

- General Commercial
- Pedestrian Oriented Commercial
- Business/Industrial
- Open Space
- Open Space w/ Recreational Use
- Community Parks & Recreation
- Public Education
- Public Land
- Research/Educational

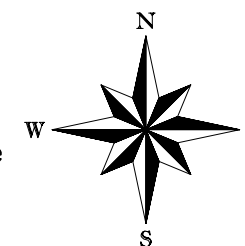
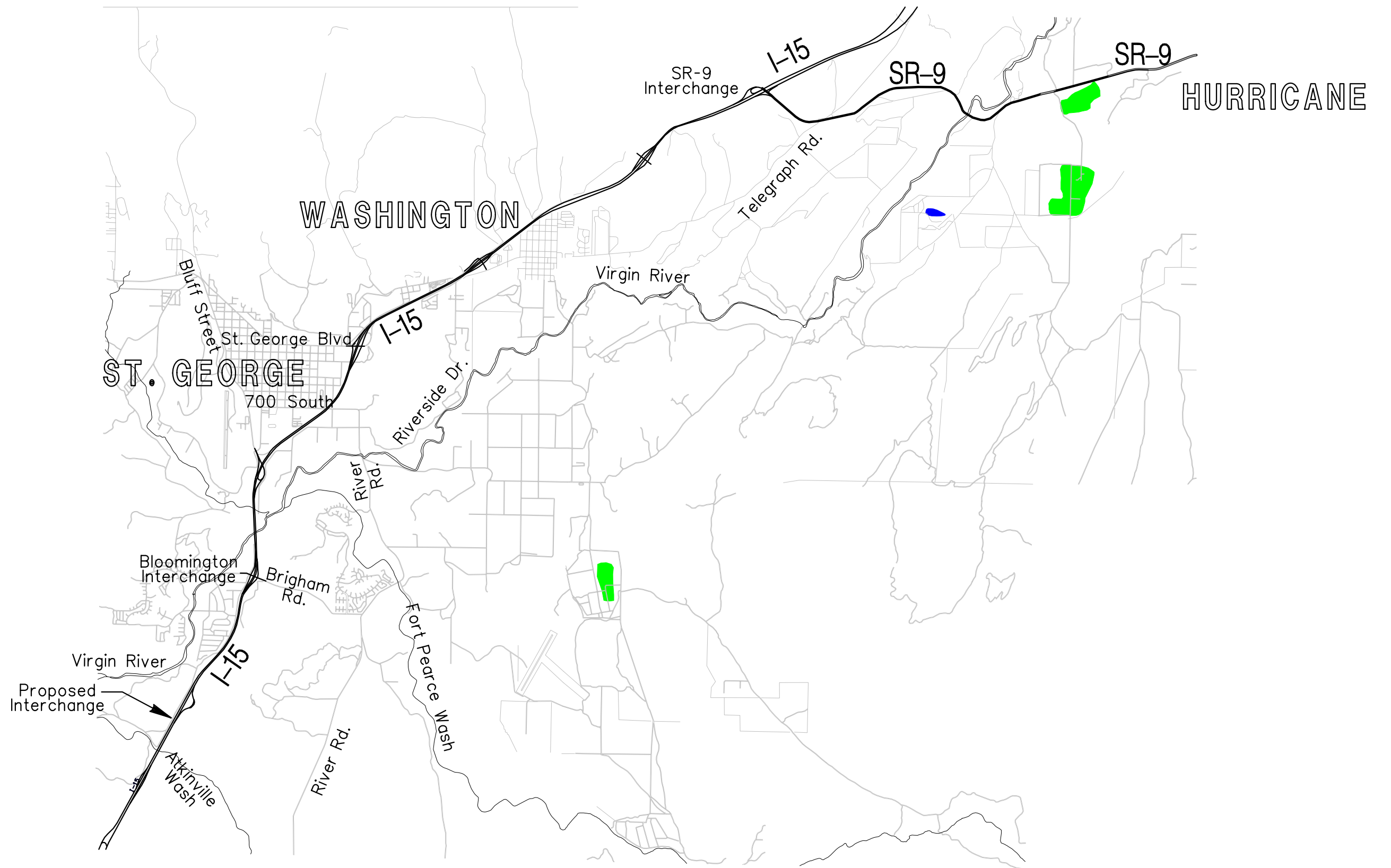


Figure 3-5

HURRICANE CITY FUTURE LAND USE MAP

Southern Corridor EIS
March 2003



LEGEND

- Prime Farmland
- Unique Farmland

0 5000 10000
FEET

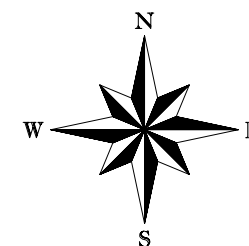
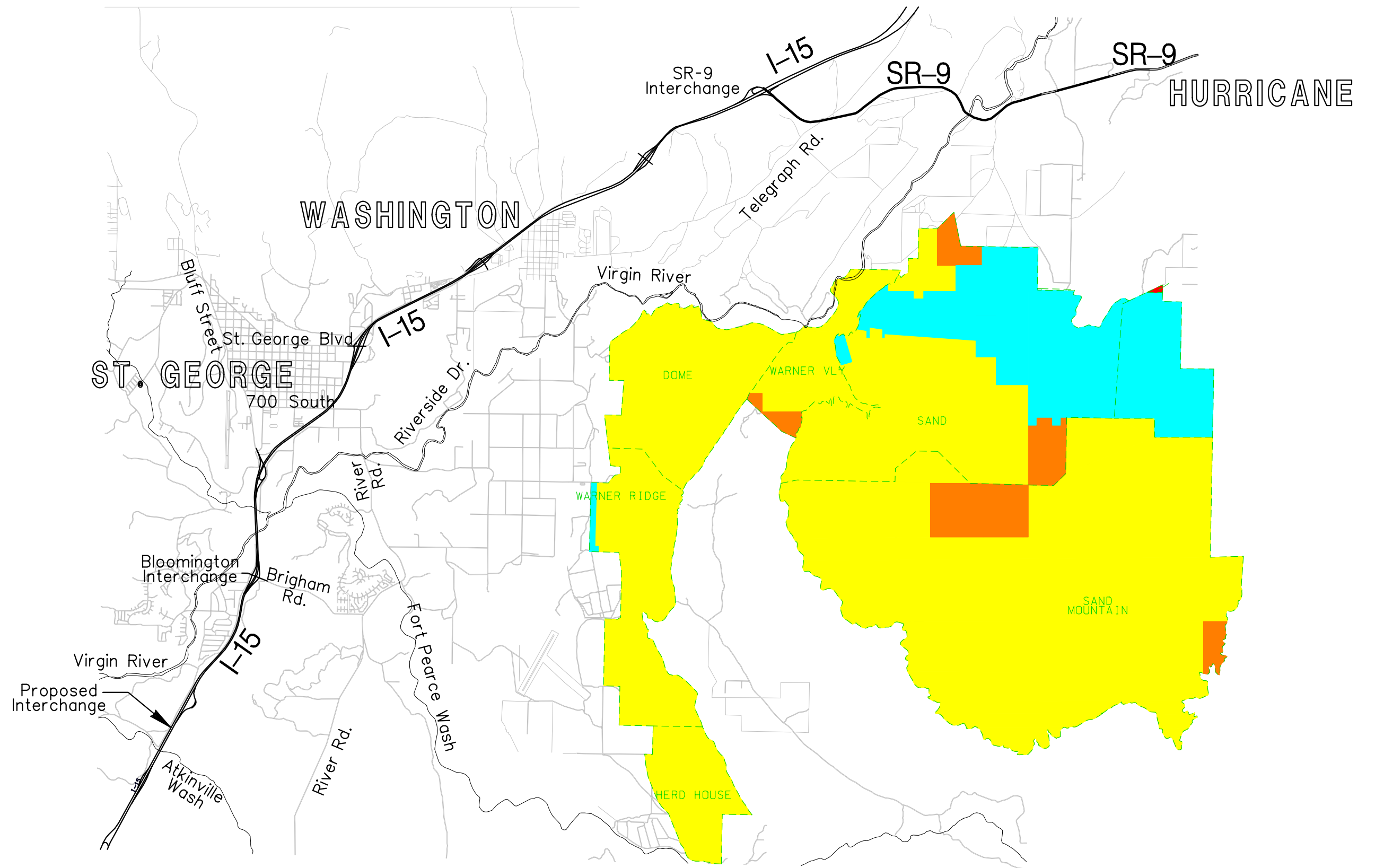


Figure 3-6 PRIME AND UNIQUE FARMLAND ADJACENT TO SOUTHERN CORRIDOR ALTERNATIVES

Southern Corridor EIS
March 2003



LEGEND

- State Land
- Private Land
- BLM Land
- Grazing Allotment Boundaries

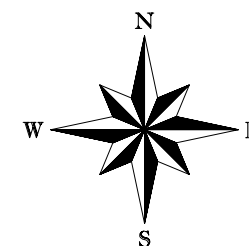
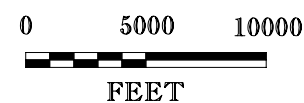
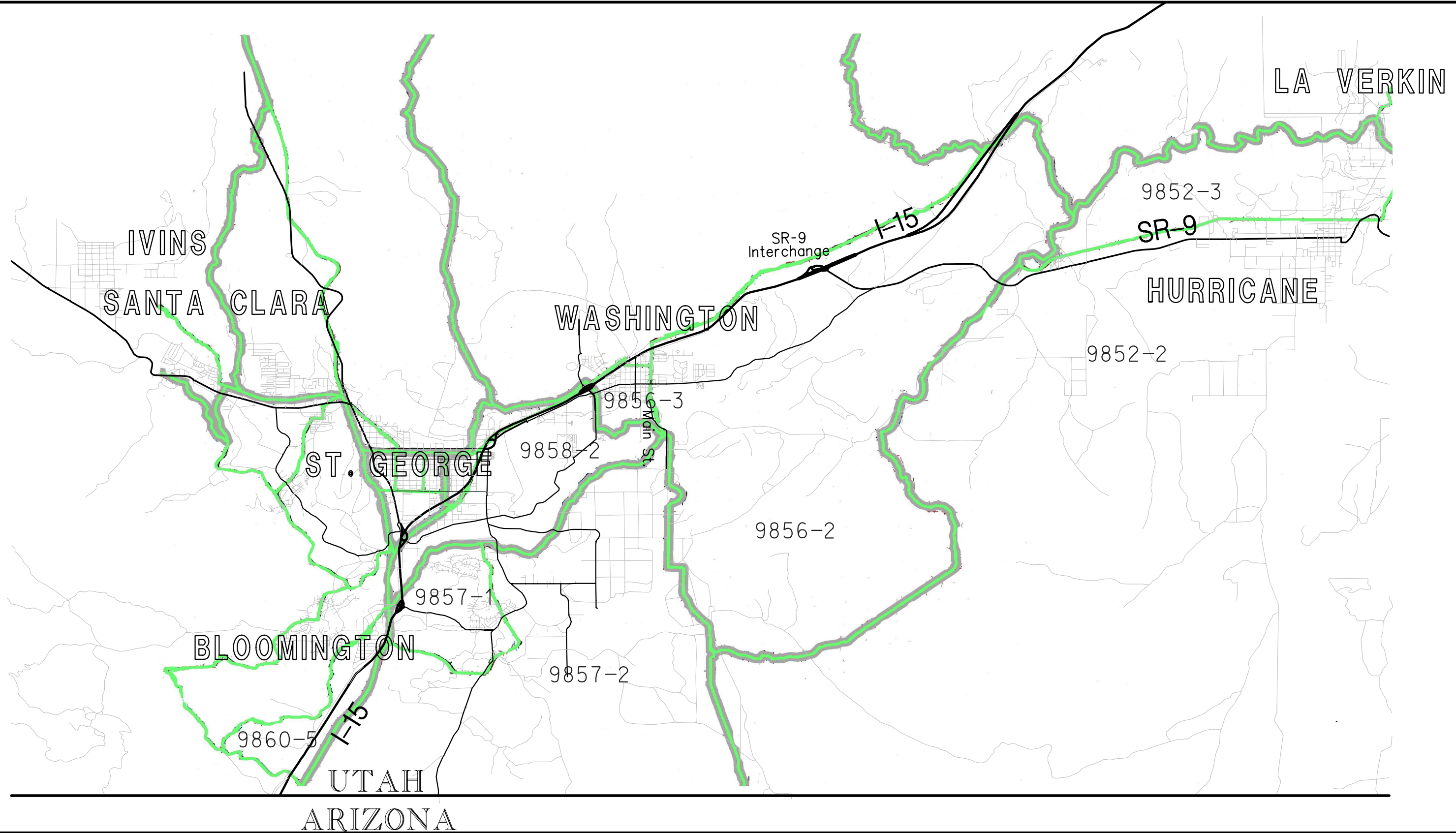


Figure 3-7
**BLM GRAZING
 ALLOTMENTS WITHIN
 STUDY AREA**
 Southern Corridor EIS
 March 2003



LEGEND

- Census Tract/Block Group Boundary
- 9857-2 Tract-Group

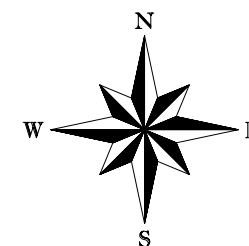
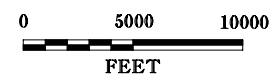
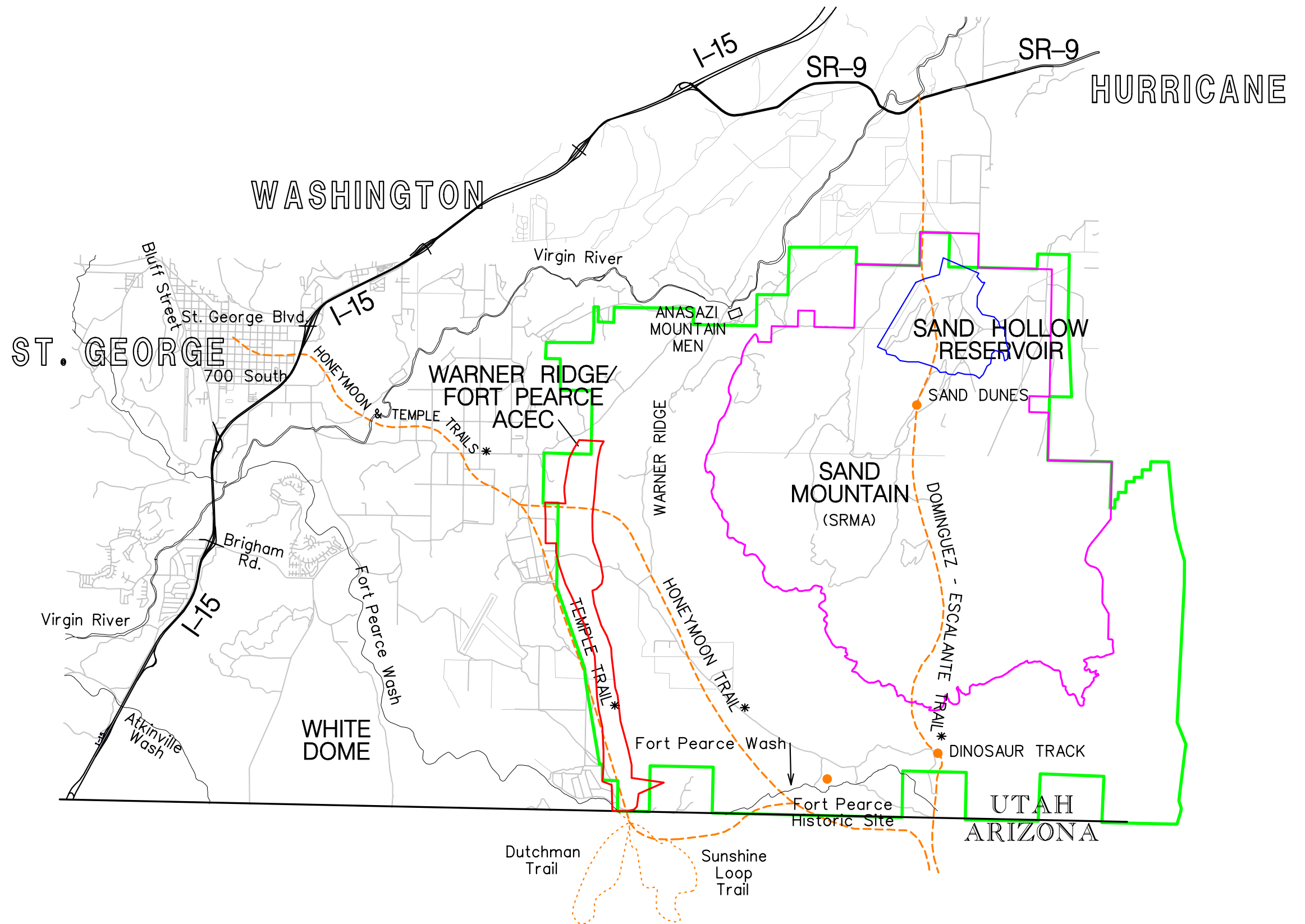


Figure 3-8

STUDY AREA CENSUS TRACTS / BLOCK GROUPS

Southern Corridor EIS
March 2003



LEGEND

- Trails*
- Motorized / Non Motorized Trails
- Sand Hollow Reservoir
- Sand Mountain (Special Recreation Management Area)
- Warner Ridge / Fort Pearce ACEC
- Sand Hollow Recreation Area

* Trails are Undefined in the Study Area, Locations are Approximate

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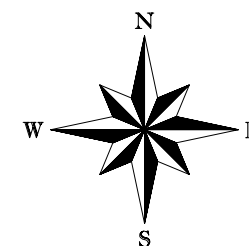
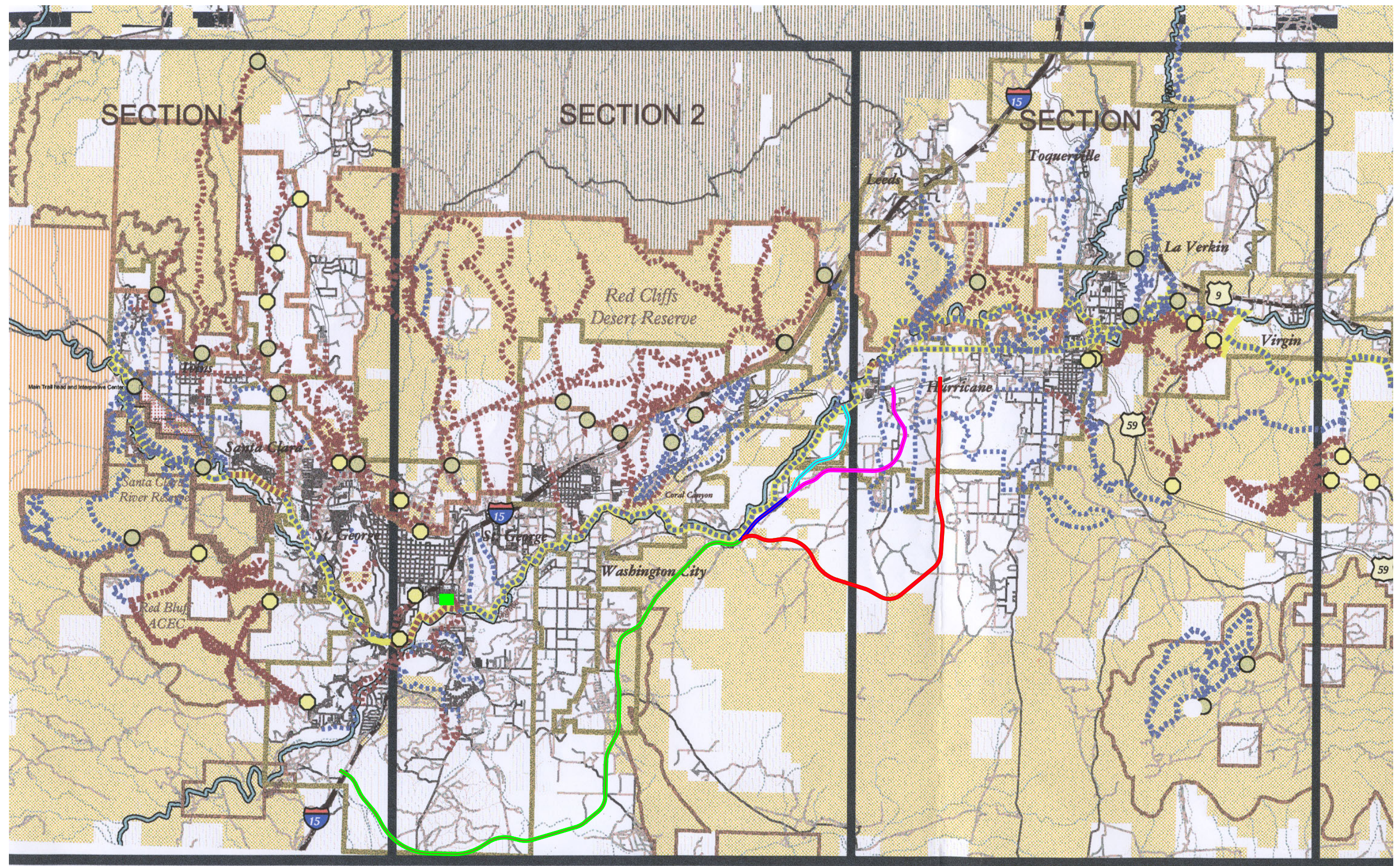


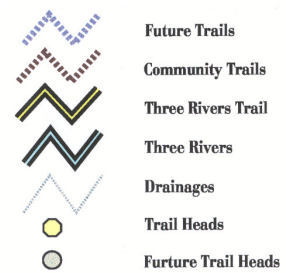
Figure 3-9

RECREATIONAL RESOURCES

Southern Corridor EIS
March 2003



LEGEND



- Cox Park
- All Alternatives
- 4300 and 3400 West Alternatives
- 4300 West Alternative
- 3400 West Alternative
- 2800 West Alternative

REFERENCE: Washington County Regional Trails Cooperative Masterplan
Obtained From St. George BLM Field Office.

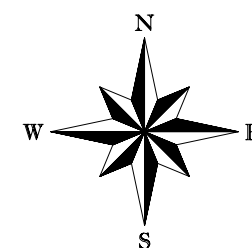
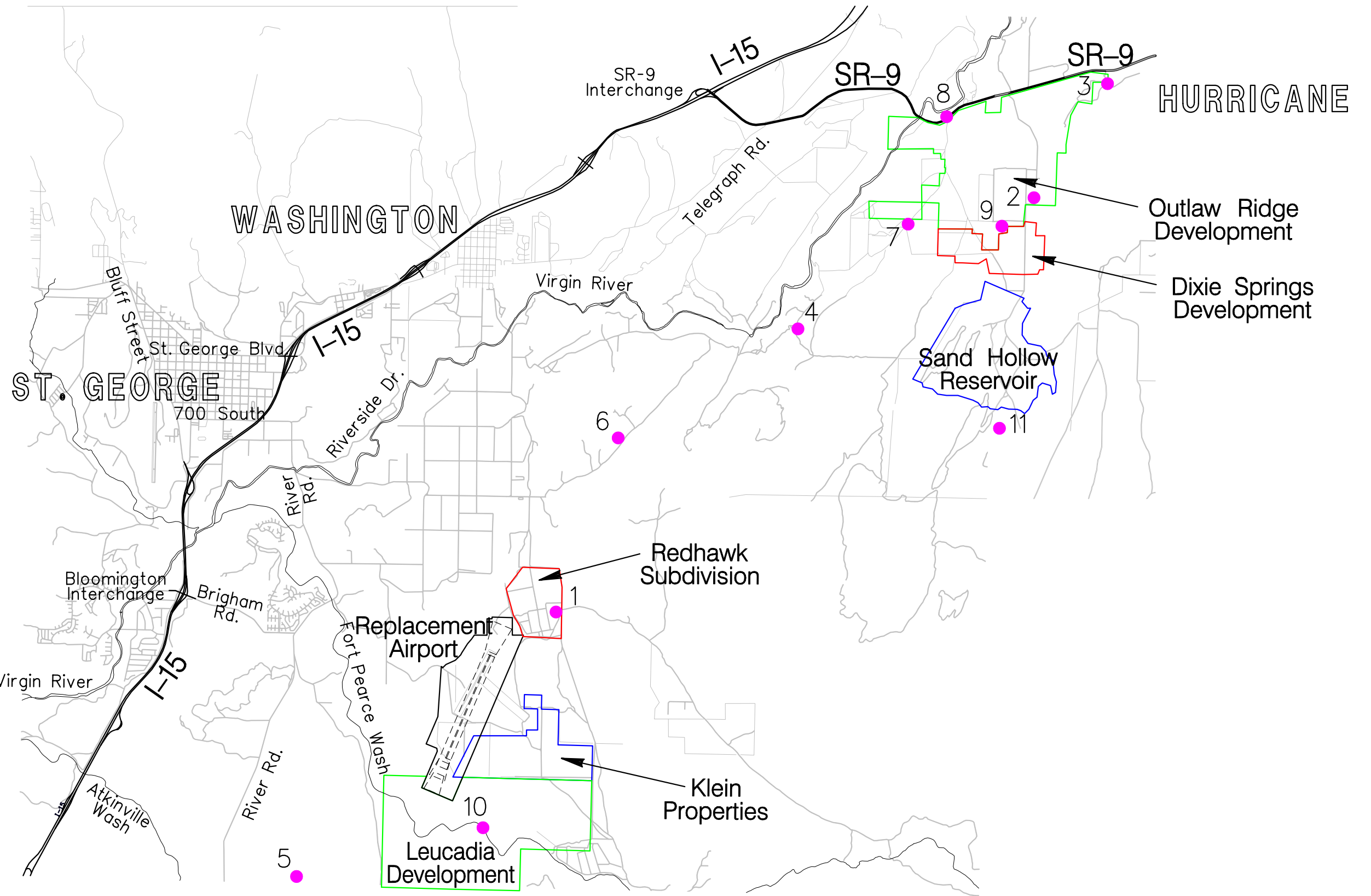


Figure 3-10

PEDESTRIAN AND BICYCLE TRAILS

Southern Corridor EIS
March 2003



LEGEND

● Noise Monitoring Location

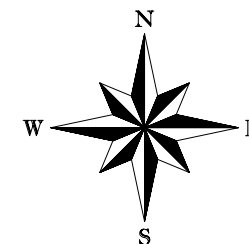
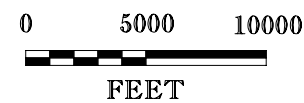
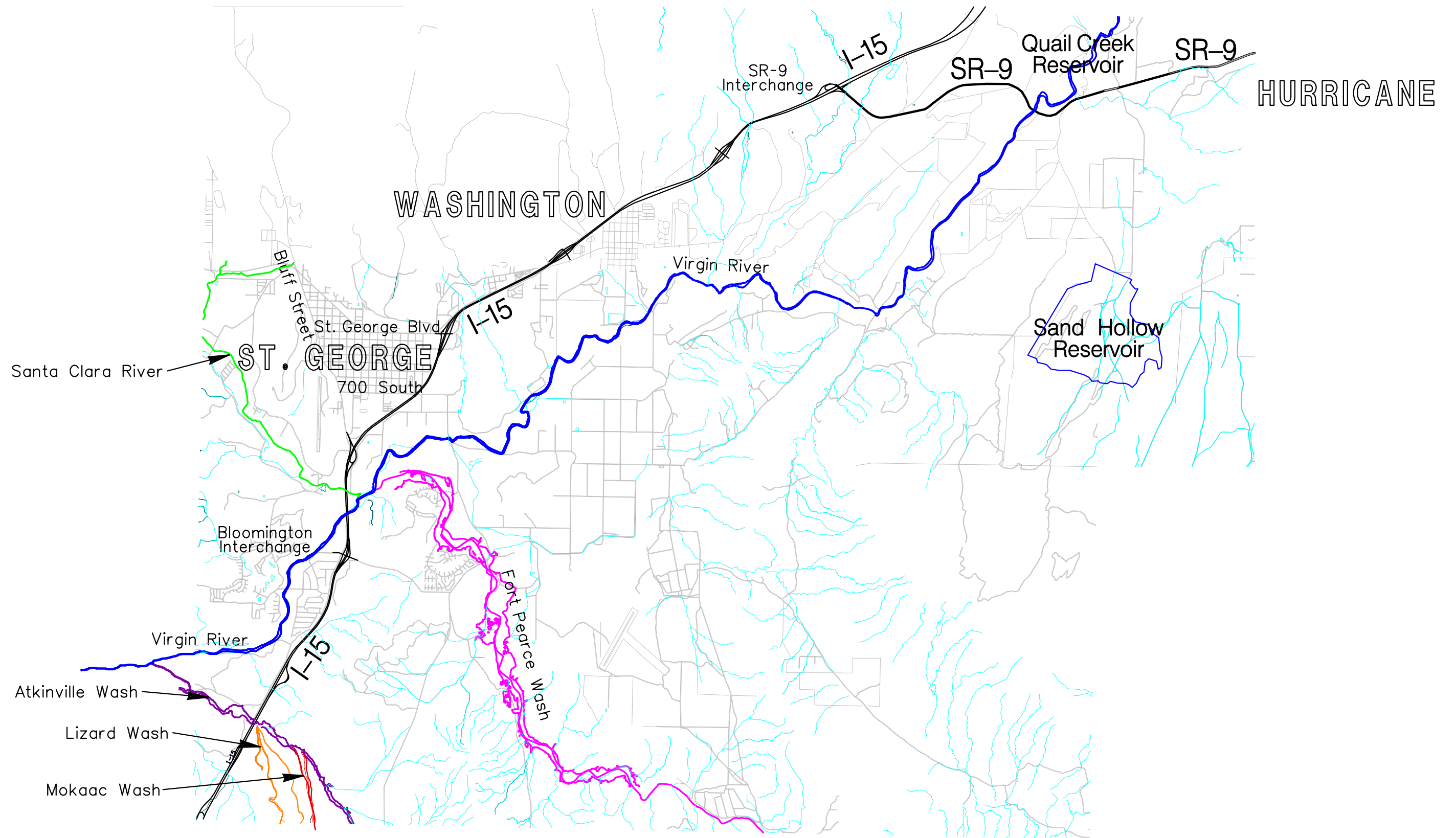


Figure 3-11

SOUTHERN CORRIDOR NOISE MONITORING LOCATIONS

Southern Corridor EIS
March 2003



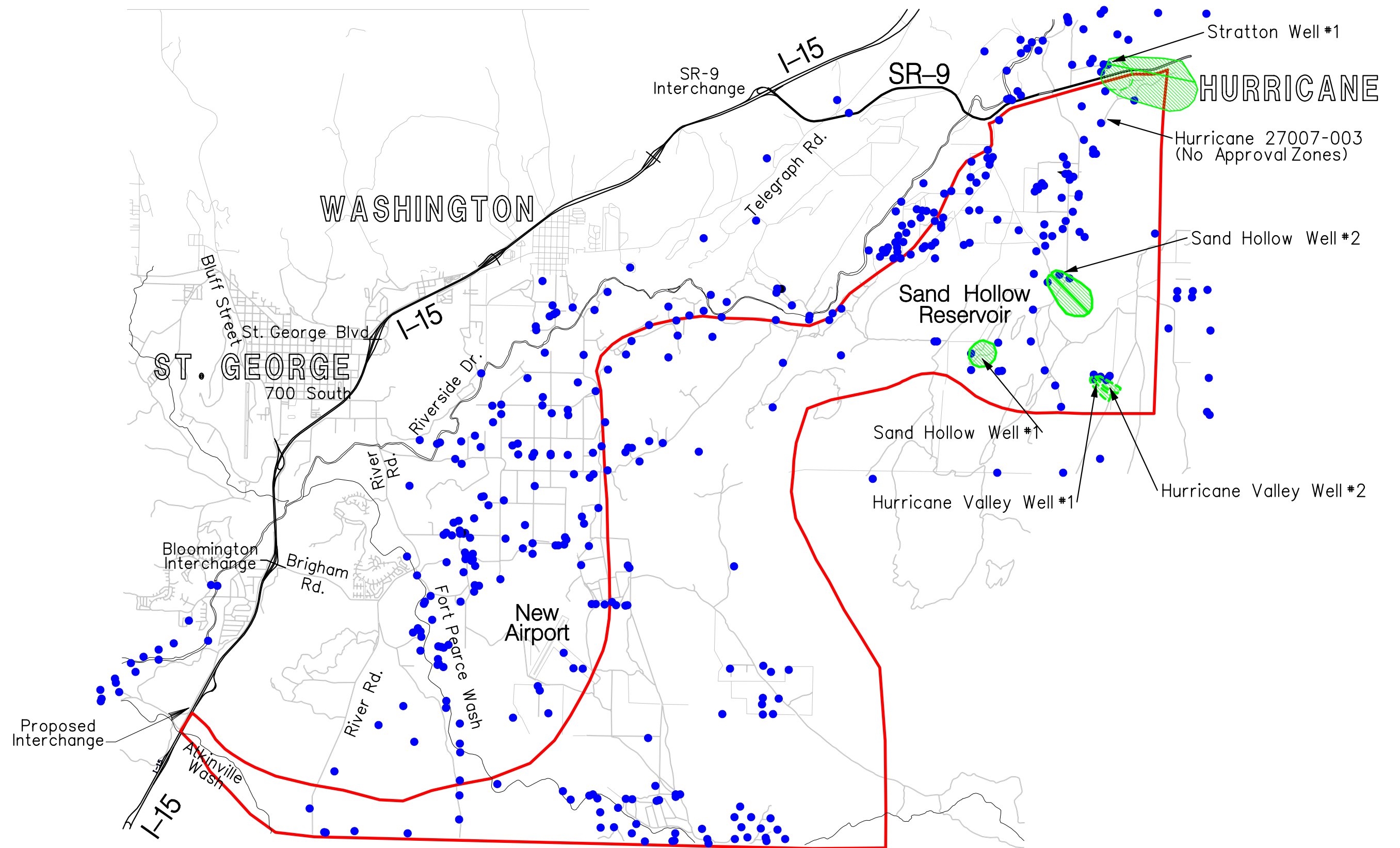
LEGEND

- Virgin River
- Santa Clara River
- Fort Pearce Wash
- Atkinville Wash
- Mokaac Wash
- Lizard Wash
- Unnamed Washes

Figure 3-12

WATER RESOURCES

Southern Corridor EIS
March 2003



LEGEND

- Groundwater Well Locations
- Drinking Water Wellhead Protection Zone (Zone 4)
- Study Corridor

0 5000 10000
FEET

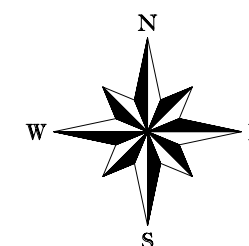
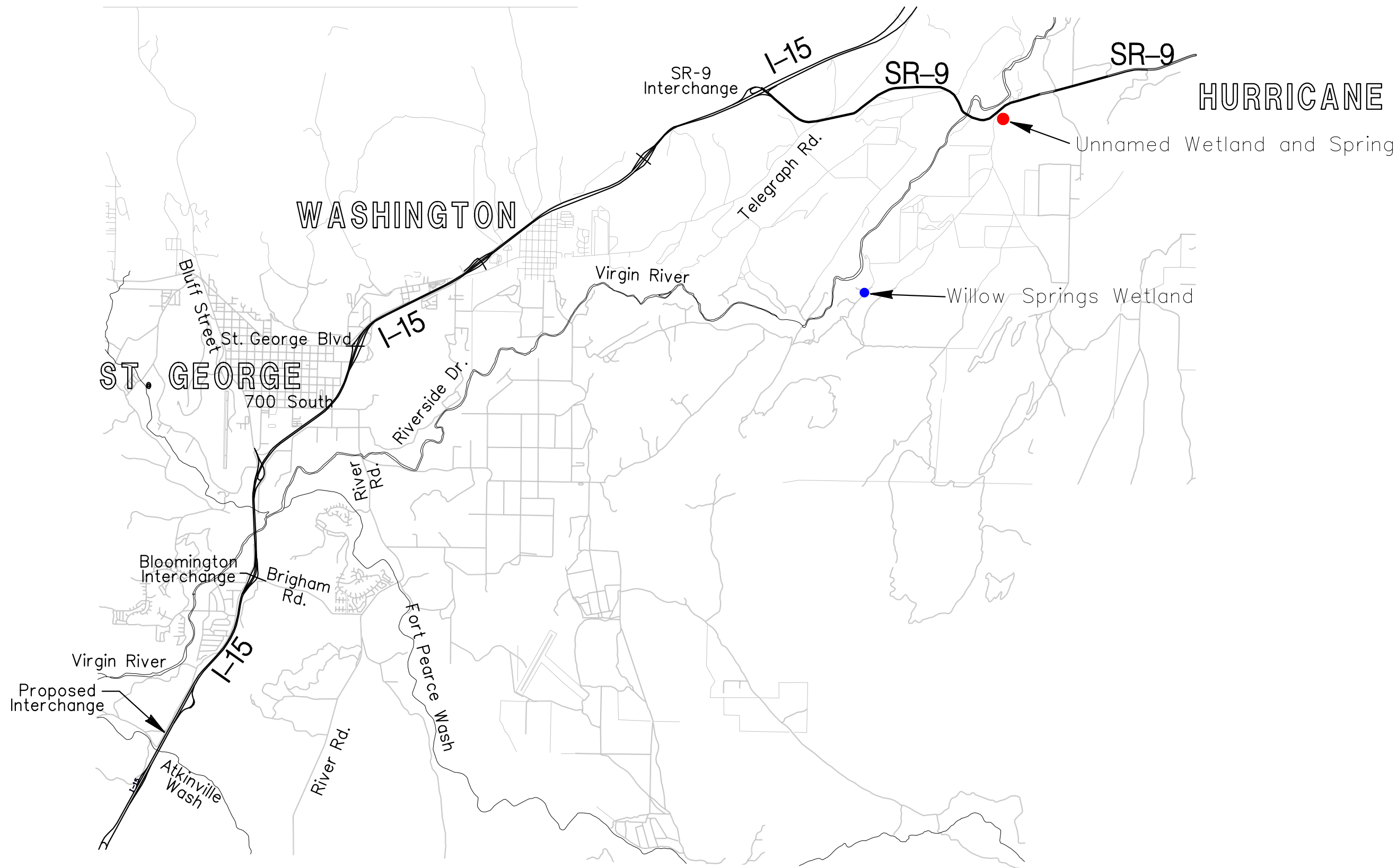


Figure 3-13

GROUNDWATER WELL LOCATIONS

Southern Corridor EIS
March 2003



LEGEND

- Unnamed Wetland and Spring
- Willow Springs Wetland

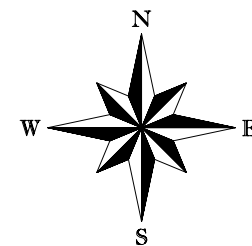
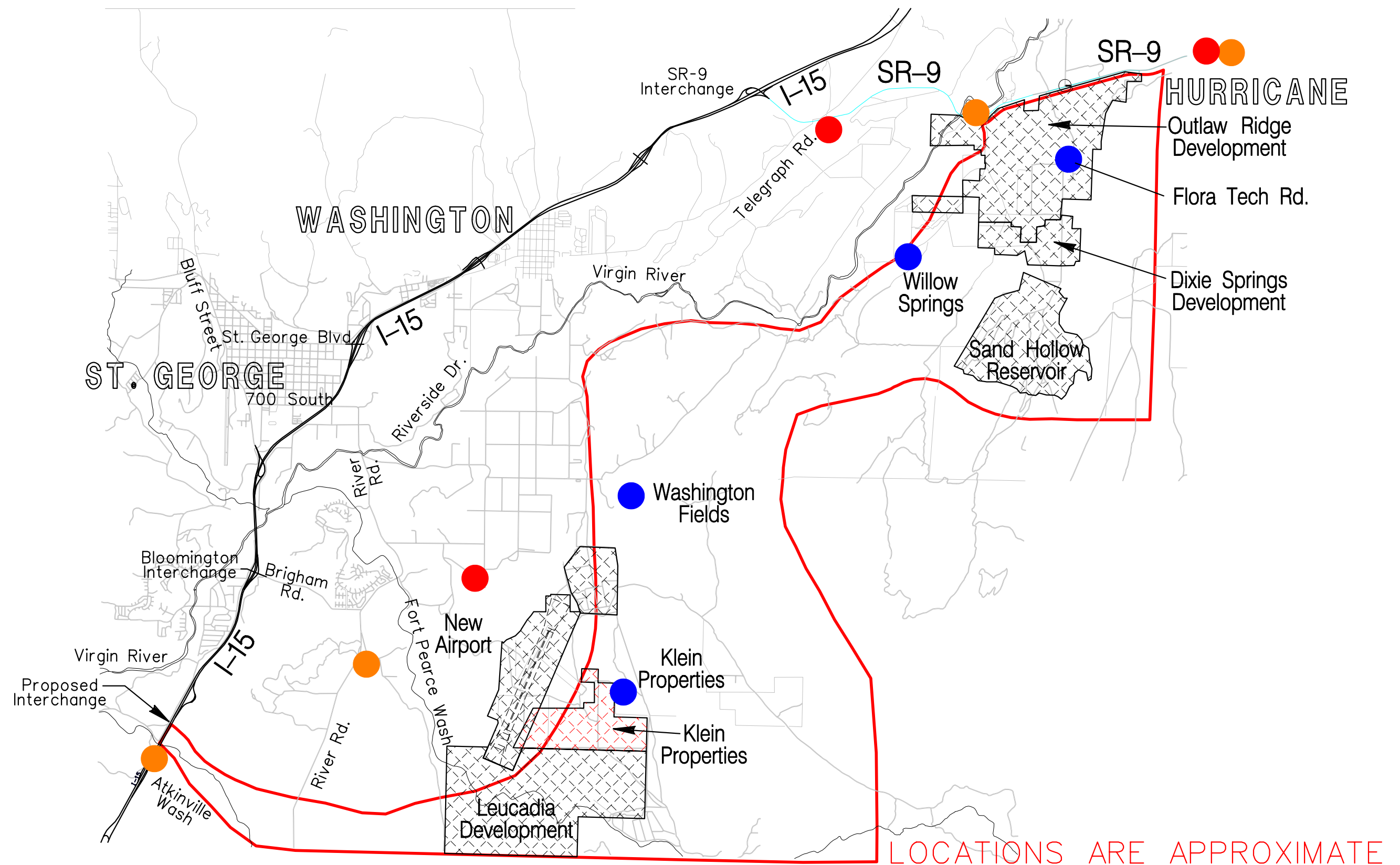


Figure 3-14
**JURISDICTIONAL
 WETLANDS WITHIN
 STUDY AREA**
 Southern Corridor EIS
 March 2003



LEGEND

POTENTIAL HAZARDOUS WASTE SITES

- UST-Underground Storage Tank
- LUST-Leaking Underground Storage Tank
- Suspect Properties
- Study Corridor
- Future Development

0 5000 10000
FEET

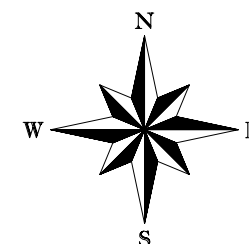
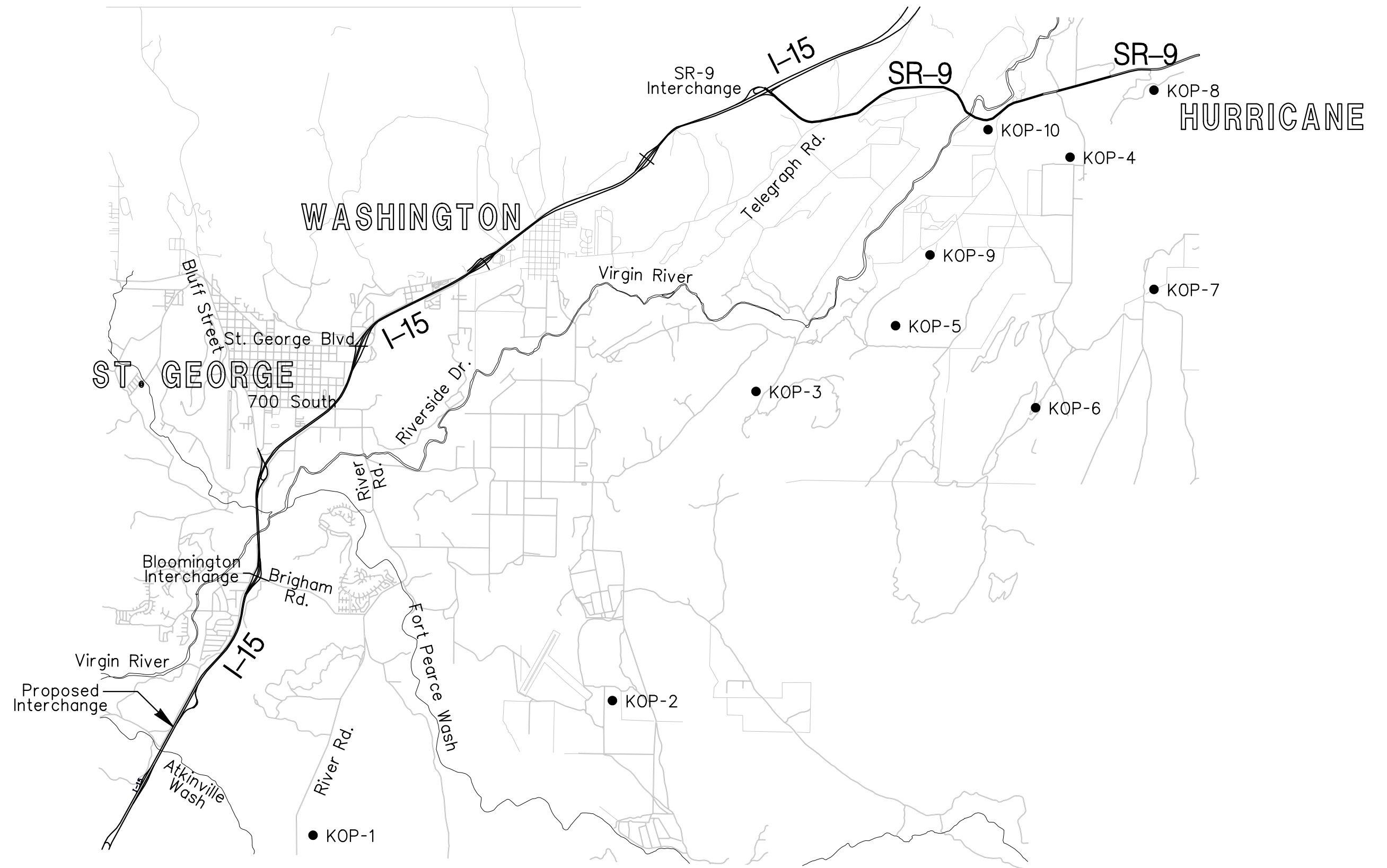


Figure 3-15

POTENTIAL HAZARDOUS WASTE SITES

Southern Corridor EIS
March 2003



LEGEND

● Key Observation Point (KOP)

0 5000 10000
FEET

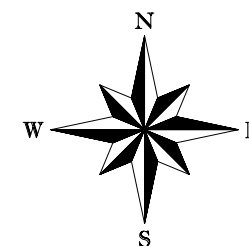


Figure 3-16

VISUAL RESOURCES KEY OBSERVATION POINTS

Southern Corridor EIS
March 2003